NEWS IN PERSPECTIVE

ECONOMIC CLIMATE

TRENDLESS MILLING with a slight tendency for upward motion characterizes the economy. Measures of business activity remain at advanced levels. Minor fluctuations appear to be throwing no strain on production or distribution. Output of consumer goods, including nondurables, has gone up to a new high. Production of consumer durables is not, however, being spurred by avid buying. A comparable lull—one which probably goes a bit beyond the normal seasonal drag at this time of the year—appears to be afflicting output of basic materials.

In some areas (example: Chicago) where somewhat isolated "recessions" happen in the midst of general prosperity, such is now the case. That is, while most prosper, many pinch.

FARM INCOME is showing improvement, but it is far from being a strong point in the economy today.

FEDERAL BUDGET SURPLUS, which was an astonishing $1.1-billion in the fiscal year just ended, probably will fall short of expectations in the current fiscal year. Originally pegged at a surplus of $4.2-billion, the year's outlook is for a smaller figure—but one that will be in black ink. Contributing to the shortfall will be the fact that business profits have lagged behind estimates. Furthermore, Congress has added to the government's obligations without making provision for additional revenues.

MANAGEMENT VIEW

NOT FOR GLAMOUR, but to own a plant that can be very meaningful to our customers and stockholders—that's why Consumers Power Co. undertook its Big Rock Point Nuclear Station, says Pres. James H. Campbell. "In Northern Michigan we will need this plant as an operating reality by mid-'60s, without regard to its R & D significance." He added: Our R & D outlay of $10-million may help to make the Big Rock project competitive with conventional plants within a 25-year period, though we do not anticipate this. Yet, we think of this project as "a venture into the economics of the future."

KEY UTILITY PEOPLE should know the company news first . . . and in the words it is announced to press, radio and TV. That's the way P. S. Co. of Colorado feels about it; accordingly, supervisory personnel get exact copies of major news releases at the same time they are released to the news media. Says the Colorado utility's information director, John Kerr: This avoids resentment arising when employees hear about company stories over radio or TV, or read about it first in the papers . . . and they feel they are in on the ground floor instead.

DOWN BY $260-MILLION in the first half of 1960 compared with the same part of '59, electric utility financing dropped off more (in dollar volume) than both gas and telephone utility financing, reports Ebasco Services, Inc. All utility financing was off 12.1-percent in this period, with preferred stock declining $75-million, common stock down $190-million. However, utility debt financing increased $40-million. Almost all (99.5-percent) represented new money, "reflecting continued growth and construction in the public utility industry, and relatively stable interest rates during this period," notes Ebasco.

WHO ARE THE OWNERS?—Northern States Power Co. has expended a great deal of effort and money over the past few years to get across this identity, only to find in a new survey that 42-percent of the people in Minneapolis and 28-percent of the people in St. Paul still don't know

who owns this utility! Comments NSP's VP Jim Owens: "It would appear that we still have a long way to go; but I feel progress is being made . . . and it is extremely important that we continue to hammer at this most important problem."

WASHINGTON INFLUENCE

DEMOCRATIC PLATFORM implies continuing heavy reliance on public power expansion. It pledges development of "efficient regional giant power systems from all sources, including water, tidal and nuclear, to supply low-cost electricity to all retail electric systems, private, public and cooperative." A "balanced, multiple purpose plan for each major river basin" is also endorsed, as are continued "low interest loans" for REA Coops. Other planks include building federal power transmission lines, broad interpretation of the preference clause, and construction of the Passamaquoddy tidal power project.

POWER SHORTAGE in the Missouri River Basin can already be foreseen, so the Reclamation Bureau is studying the possibility of setting up a basin-wide power pool. Preference customers are taking up virtually all of the MRB project's energy, and demand is expected to grow more rapidly than supply. Assistant Reclamation Commissioner N. B. Bennett, Jr., has already told MRB preference customers that they would be "well advised to begin or complete, as the case may be, planning for a supplementary source of power."

DISCOUNT RATE for public power can be used to finance transmission lines built by public agencies that buy power from the Reclamation Bureau. According to the Comptroller General, there is no legal difference between the Bureau granting a rate discount to a preference customer which builds its own transmission line and the grant of a discount to a customer which puts up cash for a transmission line built by the federal government.

ANTITRUST TRIALS for manufacturers of power switchgear are to start in Philadelphia (under a revised indictment) on Sept. 19, according to Judge J. Cullen Ganey.

SEC DOCUMENTATION rules have been modified. In revising its Rules of Practice, the Securities and Exchange Commission said that, starting next year, special permission will be needed to incorporate by reference in current filings any documents more than 10 years old. This permission will be granted for "basic documents" which have "administrative, legal, historical or other values" that warrant their retention and their being "considered valuable for incorporation by reference for an indefinite period."

APPARENT LOW BIDDER on two propeller-type turbines for TVA's Melton Hill Dam is English Electric Co. The British firm's bid of $1,730,070 beat American Elin's offer of $1,829,330 for German-built turbines. Bids were received from three U. S. firms. Their offers are being reevaluated under the Buy American Act.

REGULATORY AGENCY members' terms will automatically be extended under a new law until their successors start work. Thus, for example, an FPC Commissioner who is not reappointed will be able to stay on the job until his successor is chosen and sworn.

NEW FPC MEMBER Paul A. Sweeney has taken office under a recess appointment. Sweeney, a career government lawyer with over 35 years of federal service, was nominated to FPC in May, but the Senate failed to act on the nomination before recessing.

REA LOANS in fiscal 1960 totaled $220.1-million, the Agriculture Department says. Generating and transmission loans accounted for 40.4-percent ($89-million), and will finance almost 290,000 more kw of capacity.

NET INCOME UP 5.7-PERCENT during May, reports the FPC, compared with May, 1959, for Class A and B electric utilities in the United States. Revenues for the utilities increase $46.5-million (6.2%), but operating expenses went up $361.8-million, taxes increased $12.4-million.

NEWS IN PERSPECTIVE

TVA SPENDING during the current fiscal year includes $166-million of power funds for building and improving electric facilities. About $6-million will go to Widows Creek steam plant, scheduled for operation this fall. Some $35-million will be spent on Colbert steam plant, with about two more years' work to go. Paradise steam plant will get $65-million toward its completion in late 1963. About $12-million will be used to increase capacity at Wheeler Dam, and some $8.5-million at Wilson. Other plans include an estimated $31-million in transmission facilities and $14-million to start installation of a third 500,000-kw generating unit, either for a new steam plant or for an existing one. Pending appropriation requests still before Congress are mostly for navigational needs.

TVA STEAM PLANTS, using two "flash evaporators" instead of conventional submerged tube type evaporators, expect a $1-million saving because of additional kw output and reduction of fuel used.

AEC's ULTIMATE ROLE, after a commercial atomic industry is established, will be to act only in a way to insure public health and safety, declared Commissioner L. K. Olson in remarks at the ceremony signalling the start of major construction of Consumers Power Company's Big Rock Point Nuclear Plant. Recent example of how that role affects the private electric power industry now: the Commission's holdup of PG&E's construction approval to check out the utility's proposed new "pressure suppression" system of containment, which was okayed by the AEC's Reactor Safeguards Committee following a demonstration of the promising method last month.

COAL RESEARCH OFFICE in the Interior Department—created by new law—will be speeded into action by Secretary Seaton. First projects are short-term studies designed to "do the greatest possible good in the shortest possible time for a deserving industry" which will be undertaken with broad representation from all segments of the coal industry.

PACKWOOD PROJECT, to be built by Washington Public Power, has been issued a 50-year FPC license. The Lewis County, Wash., project will generate 20,000-kwe and cost about $5.5-million.

HEADWATER BENEFITS in the Connecticut River Basin are being investigated by FPC. If the Commission finds that non-federal projects located downstream are benefitted by federal upstream improvements, it will determine the equitable proportion of annual charges due from the private projects for interest, maintenance, and depreciation of the federal project.

INDUSTRY SIFTINGS

NEW GENERATING STATIONS across the country are adding "biggest" units regularly these days, but few tell the replacement story of modernization that is taking place at one power plant on the Cleveland Elect. Illum. Co. system. Major construction is now underway for installation there of a new 250-megawatt unit that is replacing 7 turbines and 36 steam boilers that turned out 185,000-kw. Target date for operating the completed new plant: mid-1962.

RURAL ELECTRIFICATION PROGRESS: From the Deep South, where Louisiana P. & L. Co. proudly says it tops the states there with a 98.1-percent of farms electrified to far-up Saskatchewan in Canada, where Saskatchewan Power Corp. predicts it will wind up a three-year "Complete Coverage" program next year achieving 80-percent electrification. (In 1949, only 1,466 farms were electrified.) But, says Niagara Mohawk, our problem (with most of them receiving service) is finding 'em in emergencies! The utility's solution: promote a numbering program, which saves precious time.

"ABILITY TO ENDURE"—That's what American women want built into their appliances, or so said delegates to the recent National Congress on Better Living sponsored by "McCalls." They prefer this "quality" feature to "new model" or "new gadget" offerings. How much will they spend to remodel a kitchen: up to $5000 to get it "perfect."

NEWS IN PERSPECTIVE

NATIONAL ELECTRICAL WEEK chairman for 1961 is Harold A. Webster, president of NECA, succeeding NEMA's Pres. N. J. MacDonald. Vice-Chairman is T. O. McQuiston, vice-president of Metropolitan Edison Co., Reading, Pa.

MILD SUMMER-LOW LOAD?—Not if sales of Westinghouse air conditioning units is any criterion. Company has cancelled the customary one-week shutdown for all-plant vacations at its Staunton, Va., facilities . . . and the plant is to maintain maximum production through Sept.

"ELECTRA CITY, U. S. A.," new merchandising concept scheduled to make its debut in NYC in Sept., will then be presented in the major cities of the U. S. "Try Before You Buy" is the slogan of every manufacturer exhibiting—interpreting the research-tested conclusion that personal testing has always been the most satisfying way to buy . . . "ever since the first housewife started to 'squeeze the melon' to see if it were ripe."

KITCHEN APPLIANCE AMBASSADOR—the "Whirlpool Miracle Kitchen" continued its European tour in Poznan, Poland last month, adding another 350,000 impressions to those achieved in '58 (Milan, Italy) and '59 (Moscow, USSR) . . . and the Polish people were equally intrigued with the marvels enjoyed in thousands of American homes. Eventually, says Whirlpool, more Europeans will probably see the display than the 5,000,000 Americans who saw it first.

REWIRING SWINDLE ATTEMPTS reported to the Georgia Power Co. have brought from the Better Business Bureau utility a warning to homeowners against admitting persons alleging to be the utility's wiring inspectors. The reason: "Georgia Power does not engage in housewiring, a field left entirely to electrical contractors." In the attempted swindles, some cash was collected without work being done.

"WHEN OUR NEGOTIATORS MUST RESIST any particular union demands, "says Westinghouse Pres. Mark Cresap, "it will not be because management is unreasonable, unfair, or indifferent to the interests of the unions or the employes. It will be because the security of Westinghouse is involved. And this means YOUR security." Meanwhile, GE labor talks, initiated early—noted in EL&P Aug. 1, p. 9—hit a quick snag when "management executives were forced to leave the room rather than listen to IUE Pres. Carey's abusive and obscene language." Charged GE officials: Carey "intended to work up some sort of an outburst" at the outset of the session.

PERFUMED WATER GUNS, recommended by the safety conference of the Southwestern Exchange, are being used by at least one utility's meter readers—Central Louisiana Elec. Co. The conference reported "the smell of perfume ("Sue Pree, a delicate fragrance . . .) seems to make the animal lose all interest in biting the victim . . . and the animals are not harmed by it."

IMPROVED LIGHTING AIDS are available in the form of newly published recommended lighting practices for ships and parking lots, says IES. Recommended levels of illumination are, in many cases higher than those in effect for many years.

SWITCHING SURGE PHENOMENA is to be investigated by American Elect. Pwr. and Westinghouse in a two-year research program, to be carried out in two specially-designed mobile labs.

INDUSTRIAL PARK "MAGNET" for 40 new industries has been set up by Puget Sound P. & L. in Tukwila, Wash. All transportation and underground power systems are assets offered in 325-acre site—"one of the most modern and attractive developments of its kind in the nation," according to Puget's Pres. J. H. Clawson. (To draw industry to its New York territory, Niagara Mohawk Power Co. has launched a new area promotion 4-pager, "The Empire Stater.")

"BIG ISLAND" OF HAWAII will be rebuilt better by "electric muscle," a PR campaign of the Hilo Elect. Light Co., Ltd. proclaims. HELCO suffered heavy losses from the disastrous tidal wave that swept over the island earlier this year, but urges "business as usual" in its extensive newspaper advertising.

Employe Training Key?— Supervisor

Hardly news to any utility management is a conclusion that "a constant need for employe contact training exists," as a recent survey of Wisconsin Public Utilities Association member companies showed. But, it's worth noting the opinions of the best ways to go about achieving the needed effort, as indicated by the survey:

1. The popular methods now being used to train public contact employes are "group meetings" and "movies," but the most popular method is "individual contacts with supervisor."
2. In checking the performance of public contact employes the most used method was the personal observation by supervisors and discussions with supervisors. The monitoring of telephone calls is also a method used by most companies.
3. The companies want one person responsible for training, although in most companies the training is administered by department heads and company officers. (Training is also administered by the Industrial Relations Department, Personnel Department and by supervisors and training experts.)

No Preference in Cal. On BPA - PG&E Sale

A full explanation of why a sale to Pacific Gas & Electric Company of secondary power on a 30-day withdrawable basis could proceed without either interfering with consideration of the major intertie or without jeopardizing the interest of the Pacific Northwest has been given by Under Secretary Elmer F. Bennett, Department of the Interior, to Senator James E. Murray, chairman of the committee on interior and insular affairs.

Acting Sec'y. Bennett noted that the 230-kv line involved in the sale to PG&E would not change the advisability of the major inertia.

(Continued on page 39)

Sales Plans for '60 Show Utilities Using Variety of Approaches

What are the more aggressive, sales-minded utilities doing to expedite the trend reported in EL&P's 31st Annual Major-Appliance Survey (EL&P Aug. 1, p. 54) as "a major comeback in electric-appliance sales" from 1958 through 1959? A hint of what the marketing record would add up to by year's end was given in the brief notes about 1960 sales promotion efforts accompanying the survey replies.

Some of the more pertinent supplementary comments relative to 1960 promotional plans, as noted in the questionnaire returns, are quoted here:

"A wiring program designed to upgrade residential homes and apartments, both new and existing, to a minimum of 100 amp. The company furnishes an outside combination meter socket and 6-circuit service-entrance panel, and pays a major portion of the service-entrance installation cost." (Mississippi Power Company)

"Installation of electric range, water heater or clothes dryer for $29.95 in any single-family dwelling served by company. Where necessary, this includes 100-amp service entrance, eight-circuit fuse-type switch and a 240-volt circuit to the appliance." (Commonwealth Edison Company)

"Company introduced new low 1¢-step winter residential rate to promote electric space heating load with emphasis on the electric heat pump—both central system and room units." (Houston Lighting & Power Company)

"Promotion for the first time of outdoor lighting and bathroom heating and ventilation." (Jersey Central Power & Light Company)

"We will install and service free of charge an automatic water heating system on a perpetual rental basis. Customer may, if he wishes, end the rental arrangement by outright purchase." (Quebec Hydro Electric Commission)

"Actively merchandise with 50 door-to-door salesmen plus five dealer sales promotion representatives." (Wisconsin Power and Light Company)

"Lighting continues to claim primary promotional emphasis. During the summer months college students will be employed to promote and sell portable lighting." (New Orleans Public Service Inc.)

"Discontinued merchandising automatic washers. Putting extra promotional efforts toward combination washer-dryer sales which is an excellent load builder. Also continuing program of free 100-amp service entrance into the cellar including main switch and breaker box for all new homes constructed in our territory." (Central Vermont Public Service Corporation)

"We plan to pin-point our promotions. Also will try to do more demonstrating in dealers' stores to sit-down audiences." (New York State Electric & Gas Corporation)

"This year we are trying out a policy of concentration of advertising on one appliance during the promotion of that appliance." (Central Hudson Gas & Electric Corp.)

How Utilities Expansion Plans Boost Economic Growth, Area Redevelopment

In these days when the concept of "growthmanship" can be pretty controversial, the frequent examples of electric utility companies contributing to economic growth trends across the country are ever healthier symbols of the "old American way." Along with the renewed efforts to promote Electric Living, power companies are regularly boosting business and local prosperity with new plans and projects for better living right "at home."

"At home", of course, means the quarters occupied by the utility people themselves. Examples of truly spectacular projects in the recent past are numerous, of course—ranging from CEI's attractive new Illuminating Building (first new major office structure in Cleveland in many years) to such impressive architectural pace-setters as the headquarters buildings of Utah P. & L. and Washington Water Power Co.

In some sectors of the nation, where prosperity comes easier these days, such projects do a lot by just *keeping* the pace. For example, in Sacramento, California, one of the fastest growing communities in the U. S., the Sacramento Municipal Utility District moved into its modern new central office building just a couple of months ago (see photo). In Chicago, Commonwealth Edison's Public Service Div. has matched the pace of the fastest growing area in the utility's terri-

Before—Multi-million dollar, obsolete auto manufacturing plant . . .

After—Restored, converted to Detroit Ed. service center.

Detroit Edison's Service Center Project: New Life in Industry . . . and People

"The healthiest kind of civic rejuvenation," Detroit Edison's Cisler said recently, "—depends not on infusions of public funds, but upon the investment of local capital—tax-producing dollars, to the benefit of both company and community."

And, his company has set an example: the multimillion-dollar rebirth of an obsolete industrial property, by converting Detroit Edison's Warren Service Center out of what was once the old Lincoln-Mercury manufacturing plant.

At Detroit Edison's new service center, one of the most interesting activities is the work of physically handicapped persons, employed by Goodwill Industries and the League for the Handicapped. In leased space, workers repair appliances, salvage materials under contract with the utility—"offering a real lesson in true productivity." (At left: "Employe the Handicapped" postage stamp, which will be released on Aug. 28, can be ordered from the P.O. Dept.)

The Service Center project was undertaken by the Detroit utility early in 1956, shortly after the property was purchased from the Ford Motor Company. It has brought back to life a 52-acre property located within a few minutes of downtown Detroit. The property, whose acquisition was negotiated under direction of Chester F. Ogden, vice-president in charge of purchasing, includes seven major buildings, over a million sq. feet of usable space.

The Warren Service Center stands as a practical demonstration of the feasibility of making new and productive use of properties abandoned because of specific technological changes.

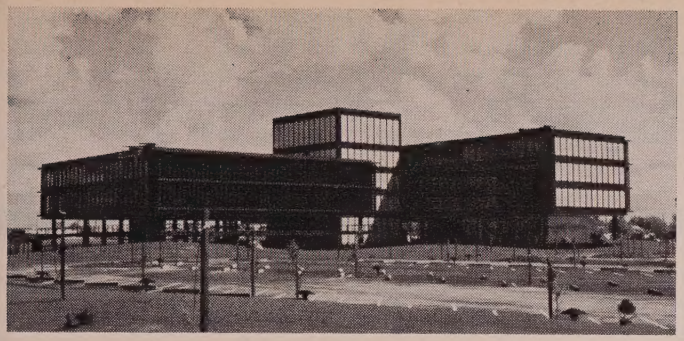
Today, various Edison service operations formerly housed in locations throughout the city are being carried on in the new center. Consolidation of some 40 warehouse, shop and other service groups in a step-by-step program direct by Edison vice-president George A. Porter, was virtually complete in May.

Up to now, Detroit Edison has invested several millions of dollars to restore the property and put it to use in further improving the company's productivity. Major work on the construction and maintenance buildings is finished and the remaining work, primarily on office buildings, will continue throughout the year.

More than 1,000 men and women —representing nine Edison departments, Goodwill Industries and the League for the Handicapped—now are employed in Detroit Edison operations at Warren Service Center.

About 250 building and mechanical craftsmen have been engaged in construction and modernization projects on the site. A large building on the northwest corner of the property, remodeled inside and out, houses some 80 employes who repair, recondition and inspect large electrical equipment and apparatus. Remaining construction activity scheduled for 1960 includes work on facilities for the company's meter department which employs about 180 persons.

The motor transportation building—a completely new one-story



Modern new office building of Sacramento Municipal Utility District occupies an attractive 14-acre site, has model "Electrical Living Center."

New area headquarters in the northwest suburbs of Chicago, this property of Commonwealth Edison features newest all-electric trends.

tory—a northwest sururban area of 146-square miles, with a population of 225,000 including 60,000 customers—with a new headquarters operation "custom-tailored, staffed and equipped to efficiently keep pace with the area, our steadily increasing customers and their ever-expanding use of electricity."

Each new utility building, naturally, provides incomparable opportunities to demonstrate modern commercial uses of electricity—from the full scope of appliance uses to such outdoor applications as up-to-date lighting for parking and yard storage areas.

But, in a few instances, less prosperous areas are quite literally being pulled up by the bootstraps . . . in the form of self-help utility projects.

Perhaps the best current example of this is in Johnstown, Pa., where last month the Pennsylvania Electric Co. started work on a new $6-million system headquarters. Redevelopment of a blighted area, employment of many of the community's construction workers over the next two years, and a symbolic achievement for other Johnstown businessmen to emulate—these are the big gains that Penelec is making possible in the principal business center of the territory it serves.

In Penelec's case the project's significance is all the greater because, like its community, the utility itself has long been less than progressive as an image for the townspeople. At least as far as its headquarters building was concerned, Penelec was, in plain terms, downright horse-and-buggy. (Part of the present office quarters was, in fact, once was a stable!)

It's more than coincidence that the utility headquarters will soon be a sharp contrast, in the term of Penelec's president of less than two years, Louis H. Roddis, Jr. The ex-submarine reactor designer made a quick mark in his new community, after moving from the AEC and the U. S. Navy in 1958 (as he is likely to do, with increasing significance,

(Continued on page 39)

structure covering 40,000 feet—was completed in early 1959. The new maintenance and repair facility, equipped to handle 25 large vehicles at one time, is in operation 24 hours a day and provides employment for 71 persons.

Each working day, Detroit Edison's stores department, with headquarters at the Center, receives, ships or trans-ships about 50 truckloads of materials and supplies. Warren Service Center stocks about 16,500 items.

Other operations at the Center include construction and assembly of display materials; training of overhead lines department personnel; and design and testing of electrical apparatus and equipment.

Detroit Edison President Walker L. Cisler believes that in the coming decade, the "renaissance" of such properties can do much for Detroit.

And Edison officials believe that the movement to restore obsolete but still useful properties as vital factors in Detroit's economy is gaining momentum. According to Edison Vice-President Edwin O. George, sales department records show that many vacant industrial buildings within the city now are being reoccupied, often for other than their original uses. He feels that this trend is strong enough to indicate a direct, favorable effect on Detroit Edison commercial and industrial power sales within the near future.

Electrical shops in Detroit Edison's newly completed service center have complete facilities for electrical apparatus inspection, repair and test. In foreground: transformers in for overhaul.

Kansas Commission Discusses Economic Depreciation

In a recent Rate Order with respect to an application for increase by the Southwestern Bell Telephone Company, a substantial amount of evidence was introduced by the Company with respect to the need for economic or current cost depreciation as an allowable expense. While these arguments have been used in a Telephone case, obviously the Kansas State corporations' position with regard to economic depreciation will be equally applicable to electric utilities. While the arguments used against economic depreciation by the Commission have been exceedingly weak, they should be of interest to the industry in order to indicate the unreasonable prejudices held against economic depreciation in certain regulatory quarters.

View on Federal Income Taxes

Among the arguments that have been advanced against current cost depreciation is the fact that for income tax depreciation only original cost is allowed. The Order of the Kansas Commission says in part:

" . . . the Internal Revenue Service does not recognize current cost depreciation as an operating expense for tax purposes (Tr. 221-224, 406-407). In view of this fact, taking into consideration state and federal income taxes, the consumers would have to furnish at least $2.12 for every dollar to be applied to current cost depreciation accruals. To be consistent, the Applicant would have to revalue its fixed assets up to date to show capital gains as income to offset the current cost depreciation expense (Tr. 1796). No evidence has been introduced by the Applicant along this line. The Staff took the position that no allowance should be made for current cost depreciation in this proceeding."

It would appear that just because the Internal Revenue Code is far from perfect and does not recognize the effects of inflation in our economy, nothing should be done at the regulatory level. Instead of abandoning the theory of current cost depreciation because it does not fit into the income tax code, it would be well for industry to persuade the Government to change the Internal Revenue Code, which would permit the use of economic depreciation.

As to the statement that the applicant would be subject to capital gains tax because of the revaluation of assets, such a statement is completely nonsensical. Current value depreciation is only claimed for rate making purposes, and there is no question of revaluation of the assets of the corporation on the books of account. However, even if this were done, no liability for capital gains is incurred until the assets are sold.

Effect on Debt Security Holders

In discussing further the problem of economic depreciation, the Commission said in part:

" . . . this unreasonable burden which would be placed upon the rate payers would benefit only the Applicant's *equity* security holders. The annual depreciation charges would be computed upon the basis of all the property in service, a large portion of which has been created out of the funds resulting from the sale of debt securities. *The Applicant has contracted to make the payments on those debt securities only in the dollars current at the due dates.** The debt security holders, therefore, would obtain no benefit from such an inflated depreciation charge, whereas the equity security holders would obtain a windfall."

It would appear that the italicized portion of the above excerpt answers by itself the erroneous contention which this paragraph raises. Everyone knows that debt holders are entitled only to so many dollars which they contracted for, and that they do not participate in the profits, and by the same token, short of bankruptcy, they are protected from losses. The Commission's claim that the common stockholders will have a windfall because of the use of current cost depreciation is completely in error. The only thing that economic depreciation under proper accounting rules will do is to maintain the integrity of the property instead of merely amortizing the original cost dollars of the plant account. However, if there is a windfall, then the equity holders, who are the owners of the whole property, are entitled to it, since they are the ones who have underwritten the risks of the business.

Interestingly enough, the Commission makes a tacit admission as to the problems of inflation when it says:

"Moreover, there would be discrimination among the equity security holders, the degree of which would depend upon the purchasing power of the dollars *at the time each security holder invested in the Applicant company.*"*

Position on Economic Depreciation

The Commission quoted the Bell system's position in regard to economic depreciation as follows:

"If the situation is clearly understood, it is obvious that the amount of replacements cannot affect the amount of this expense (depreciation) item. *The amount of the expense item is determined by what is put into the plant and used up. These factors determine it absolutely. The result would be exactly the same if no replacements were ever made . . .* *

"The argument that the amount of replacements affects the amount which should be charged to operating expenses on account of depre-

* Italics supplied.

ciation of property is unsound because it assumes that it is the replacements which measure the expenses which the company has incurred. Clearly they do not. . . .

"It is perhaps worth while to note that *this talk about replacements is very largely based upon a fiction.** The respondent companies have seldom replaced property that was no longer available for service. Property taken out is not replaced in kind but other and different property is usually added to the plant."

It would seem from the foregoing that clearly no question of replacement of property is involved. Yet the Commission carefully evaded this relatively simple issue by quoting one of the Staff's chief accountants to the effect that:

"I do not consider the determination of depreciation on so many unknowns consistent with sound accounting practices, for to employ these practices and methods would introduce an element of determining depreciation expense in a given accounting period on an asset not yet acquired at a price not yet known, *to replace an asset that may not be replaced at all.*"* (Tr. 1740).

Presumably the Commission thought it good tactics to make an answer to a question never raised.

* Italics supplied.

PREFERENCE—*from page 35*

Secretary Seaton then indicated this view:

"No preference consequences would attend such power, the chain of connection with the United States having been severed at the point of sale to the Company. The preference provisions would come into play with respect to sales for use in California only if the purchaser of such power is a preference customer. In other words, unless a preference customer purchases power from Bonneville Power Administration for use in California, the mere fact that nonpreference customers are purchasing power for use in California does not establish any entitlement in California to continued deliveries."

BUILDING—*from page 31*

in the electric utility industry.)

In short order he headed the Greater Johnstown Committee, which he recently told:

"In planning this building, full consideration has been given to Johnstown's future development plans, as well as to the economic welfare of its citizens and its industries. We believe that starting construction at this time is a testimonial to the growth and progressive spirit of your electric company and proof that it has faith in the future of Johnstown."

The Penelec project will include: an office building 220 feet long, 60 feet wide and 60 feet high with an attached two-story wing, 120 feet by 70 feet; a stores and line building, 300 feet long and 100 feet wide, varying between one and two stories in height; and a service building, 624 feet long and 100 feet wide, about one-third of which will be two stories high.

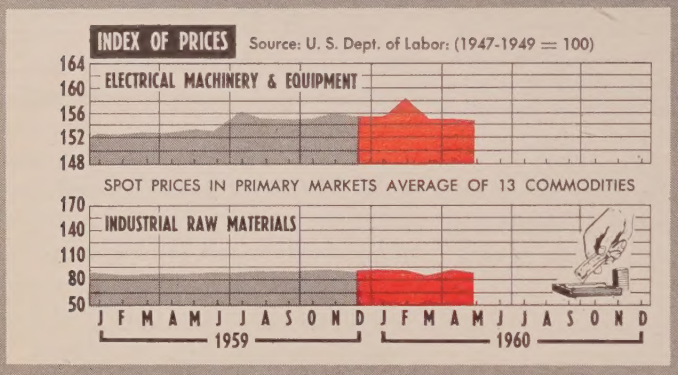
Designed by the architectural firm of Lacy, Atherton and Davis of Harrisburg, Penelec's main office building, as well as the other new structures, will have a steel framework. The front and sides will have alternate panels of glass windows and porcelainized steel panels extending from the ground to the roof. Expanded aluminum panels with an octagon design will be placed in front of the windows. The modernistic motif, thus created, will be accented by rows of fluorescent lights between the glass and the panels. The rear wall will be built of red brick.

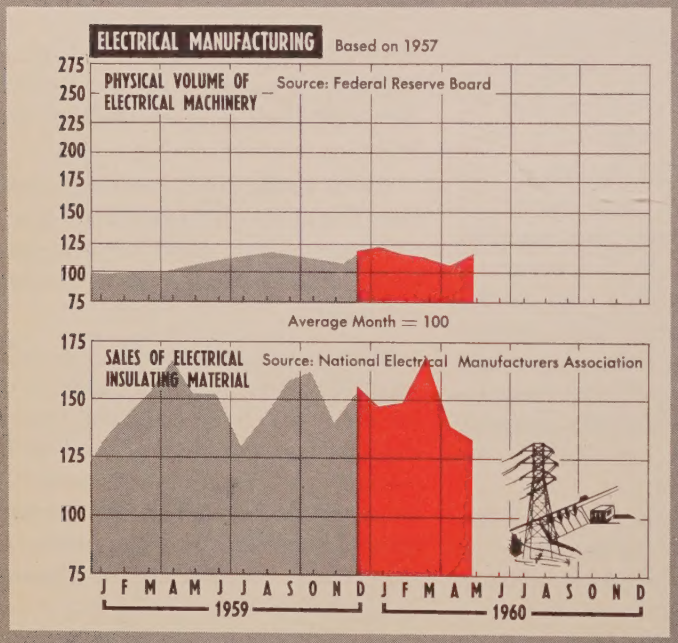
Glass, brick and porcelainized panels will also be used in the other buildings which will feature bowstring construction of the one story sections.

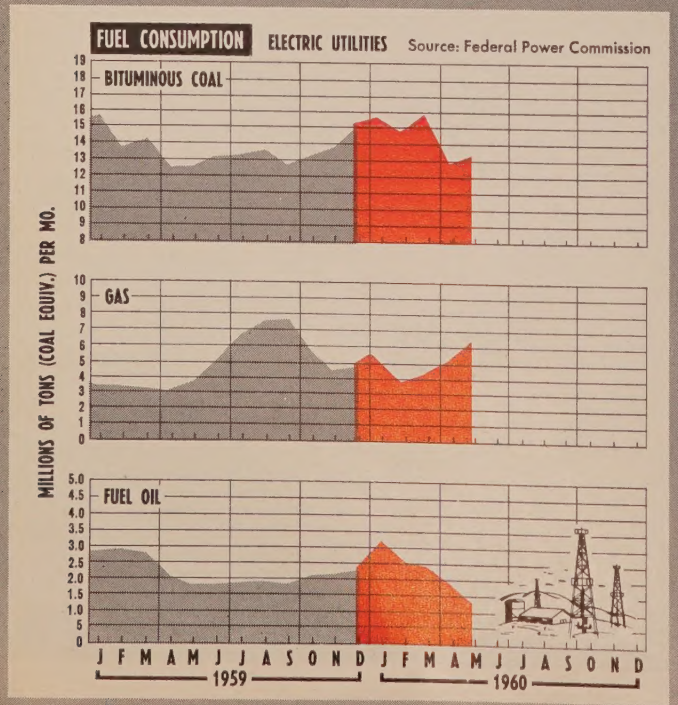
Five combinations of electric heating and cooling equipment will be used to demonstrate the versatility and availability of automatic electric systems. Much of this equipment will be located on the ground floor of the main building behind a glass wall so that it can be viewed by the public.

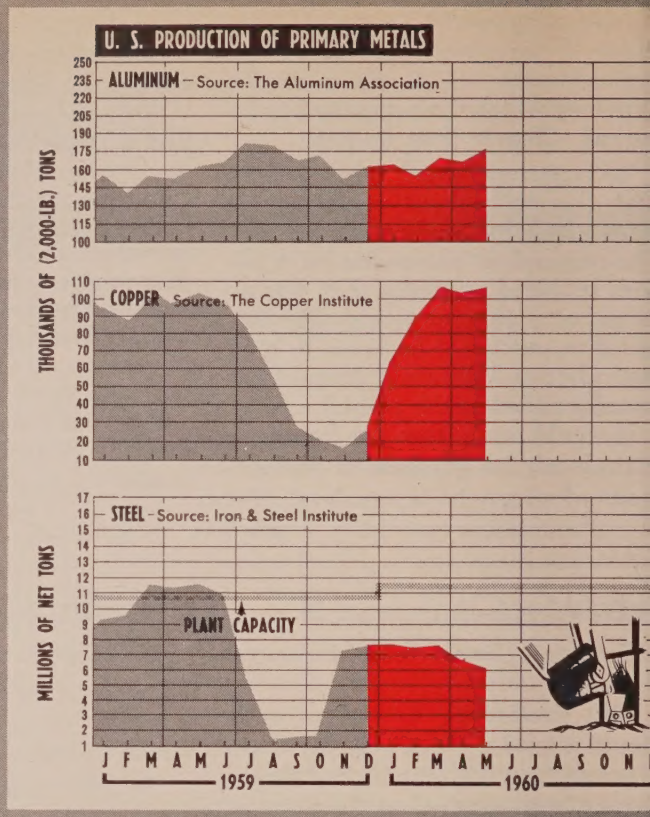
Conferring with engineers of the Swedish State Power Board in Stockholm is ELECTRIC LIGHT & POWER'S Eastern Editor, Bob Blatt (right), who spent 6 weeks on the continent during June and July. Shown in the picture with Bob is Bengt Nordström (center), chief engineer, and Lars Norlin (left), divisional chief of Transmission, both of the System Planning Department. In addition to covering the CIGRE meeting in Paris, Bob visited the top engineers and executives of the leading European power companies in Glasgow, Edinburgh, London, Paris, Geneva, Lausanne, Lucerene, Zurich, Milan, Florence, Rome, Vienna, Dusseldorf, Essen, Stockholm, Oslo, and Copenhagen, arranging for feature technical articles dealing with important new developments in power system design and operations.

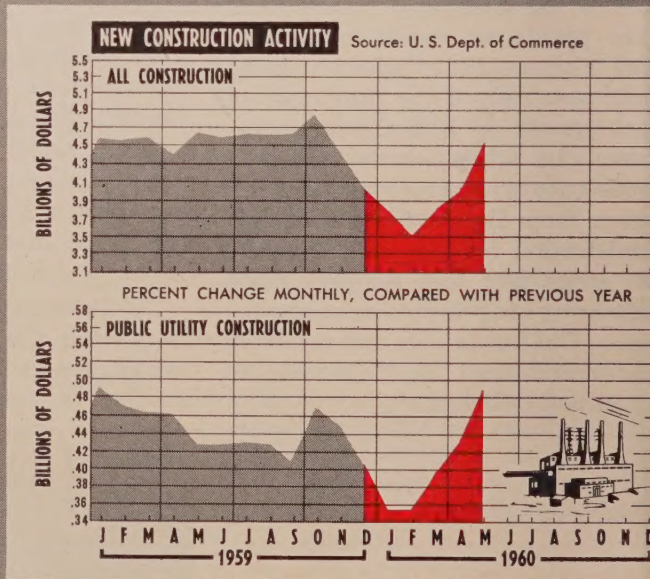
MARKETING GUIDEPOSTS

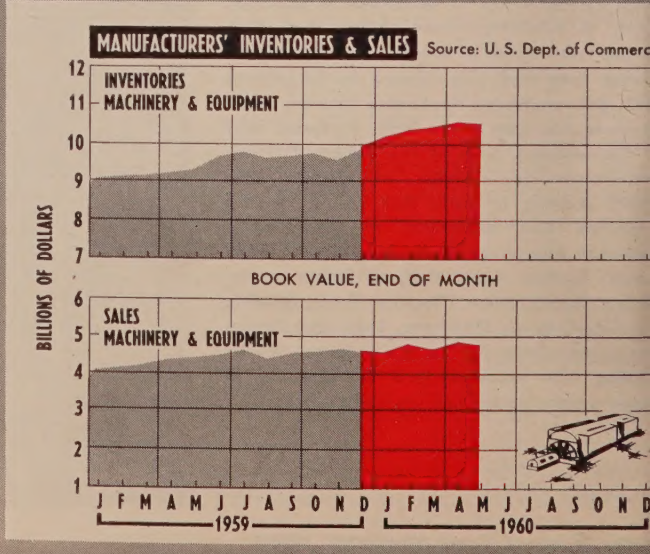












NUCLEAR NEWS

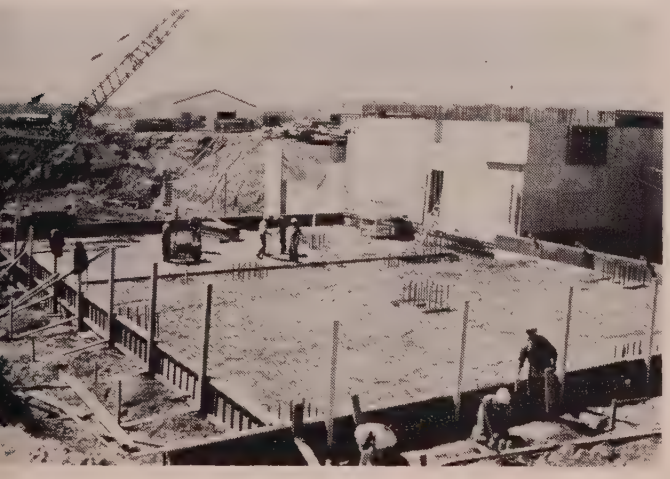
UTILITY COMMISSION ENGINEERS will have a difficult, though important role during the period of transition and initial growth of the nuclear power industry, the AEC's U. M. Staebler told the recent annual conference of Utility Commission Engineers. He suggested: "Your efforts to learn about nuclear energy and the resultant judgements based upon knowledge of its characteristics, problems and promise are certain to assist in assuring the continued availability of abundant energy at low cost for growth of these United States." Mr. Staebler cited these significant characteristics of nuclear energy: (1) the essential absence of any limitation in temperature which can be achieved; and (2) the fact that nuclear plants are much more responsive to load changes and can be changed in power level much more quickly than fossil-fueled plants.

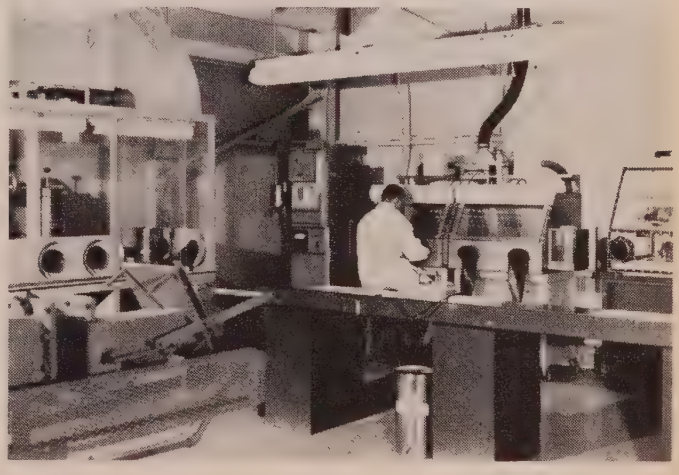
CONTAINMENT STRUCTURE SAFETY tests being conducted for the AEC by the Ballistic Research Laboratories at the Aberdeen Proving Ground, Md. indicate that the response of four model steel shells is entirely within the elastic range.

NUCLEAR POWER COSTS are estimated in newly available publications: *"Economic Potential and Development Program as of 1959"*—Part II of the AEC's four-part study of the Civilian Power Reactor Program (TID-8517, 98 pages, 70 cents, from the GOP, Wash. 25, D. C.); and *"Introduction to Nuclear Power Costs"* by Arnold Rochman, a monograph, 48 pages, $2.95, from Simmons-Boardman, NYC.

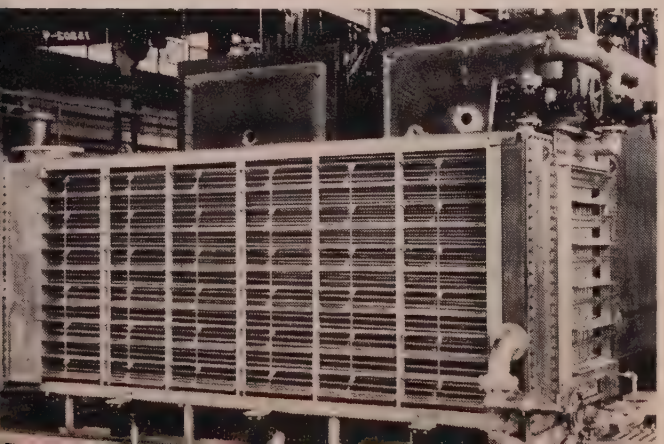
Editor's Note—EL&P incorrectly quoted the AEC's Dr. Frank Pittman in the July 15 issue. He recently referred to: "the mark of success for efforts to apply nuclear energy in the U. S.—the possibility of saving consumers an estimated $200-*million by 1980.*"

Portions of this 66,000-kw Pathfinder Plant to be operated by Northern States Power Co. in So. Dakota, are under roof by now. New developments of ceramic fuel cladding, perfected in this new Allis-Chalmers laboratory (right below), will be incorporated in the Pathfinder reactor.

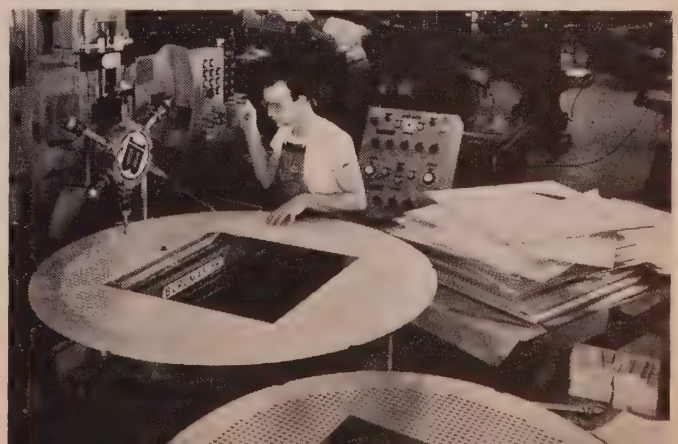




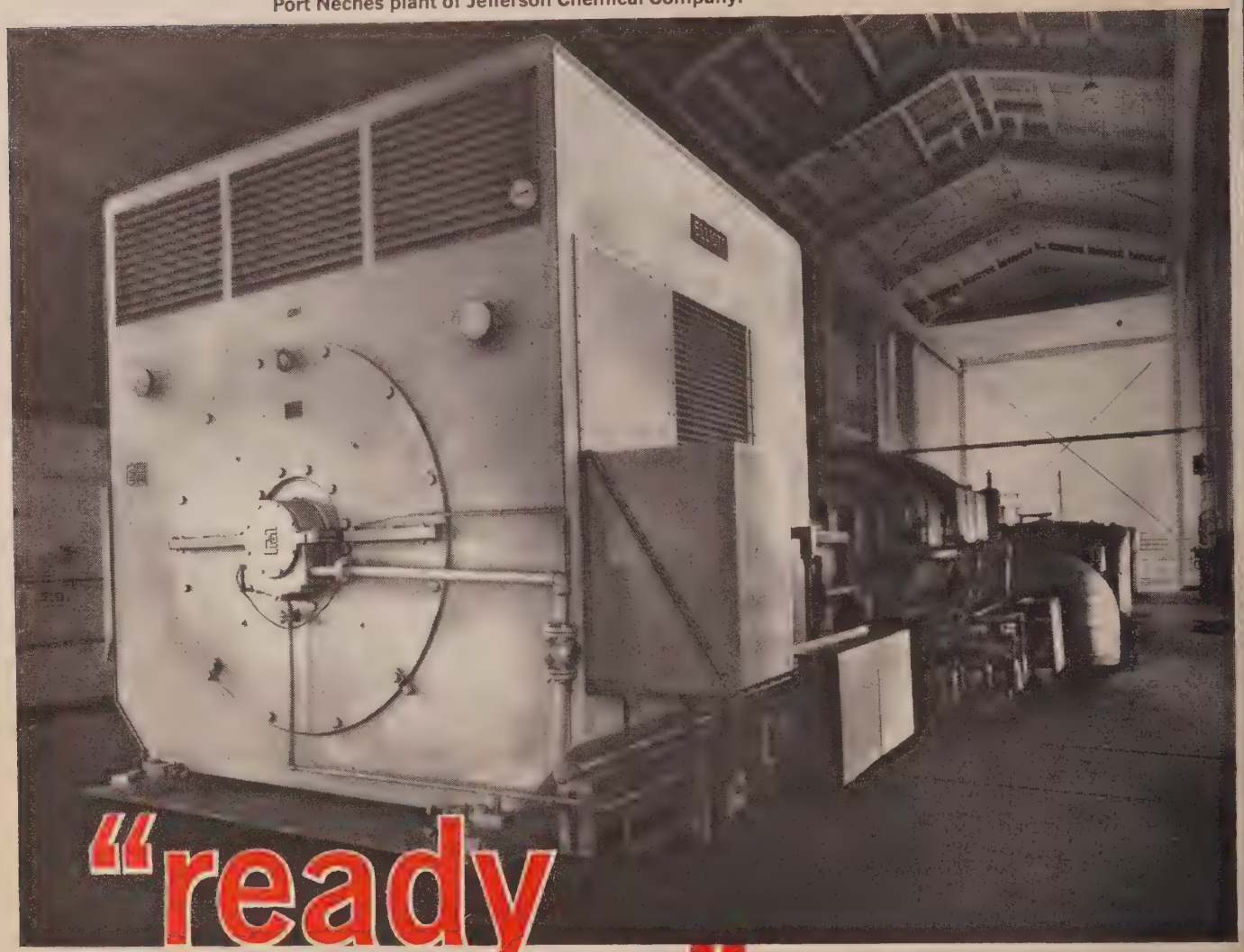
Feasibility study of portable nuclear powerplant's steam generator and secondary loop preceded the construction of special equipment, including this unique test model steam-to-air condenser (eight-ft wide, eight-ft high, 20-ft long). Built by Westinghouse, it is designed to operate in a temperature range of 125 F to minus 60 F. The 1250-kw plant was developed by the Martin Co. for the AEC. (Another AEC project, announced last month, aims at the development of a 2000-kw mobile plant, to be designed by Nuclear Development Corp. of America and the General Motors Corp.)



Numerically-controlled turret drill, first automated machine installed under a three-year program of the GE Atomic Power Equipment Dept., is shown completing 17,200 holes in special plates for a control rod material development critical facility. Example of the efficiency of automation, the job took two weeks, compared with a nearly three-month operation to turn out the first set of plates for the facility back in 1957. The Burgmaster tape-controlled machine is one of the first applications of automated equipment in the nuclear industry.



VERY PLEASED were user and contractor with the ease of installation and start-up of "Big Bertha," the 7000-hp Elliott motor shown below. It drives a compressor in the Port Neches plant of Jefferson Chemical Company.



"ready to run" when delivered

means easy, quick, economical installation

Elliott eliminates large motor "bugs" at the factory

A fundamental feature of Elliott motor manufacturing is to make certain that all motors are "clean" when shipped. Careful checks, tests and adjustments at the factory eliminate potential trouble-making "bugs" before shipment, making installation, start-up and early operation smooth and easy.

A good example is the 7000-hp Elliott motor shown above, dubbed "Big Bertha" by the operators. It went into operation very, very smoothly, which pleased both contractor and customer. And this is not an isolated case; the Elliott reputation for clean, bug-free motors is very well established. "You can bolt them down and start them up" is what our customers say of Elliott large motors.

Of course, "cleanliness" is only one manifestation of the high quality and perfection of every detail that is characteristic of all Elliott large motors. An interesting sidelight on this particular installation is that the motor was found to be carrying a load considerably in excess of guaranteed rating, without the slightest sign of distress

It is no wonder that experienced users say that the *very finest large motors built are built by Elliott.*

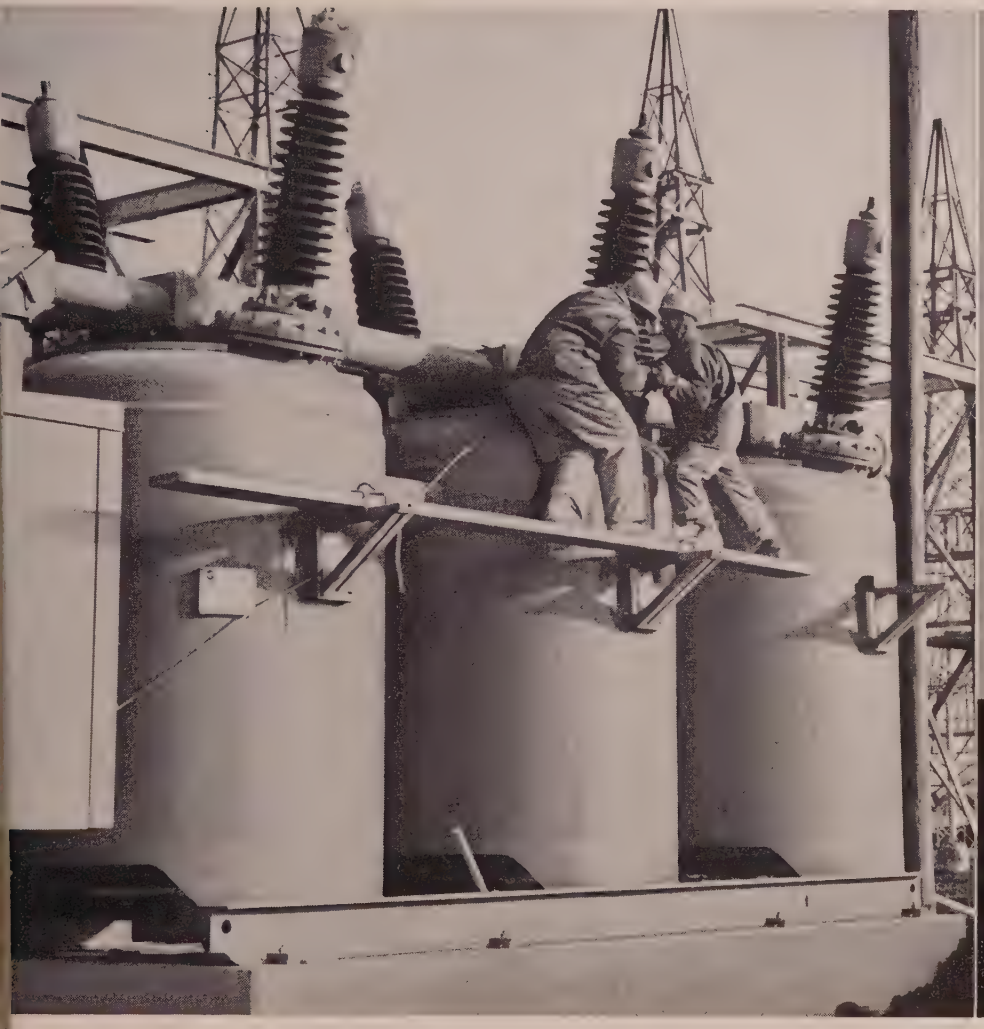
ELLIOTT Company
Ridgway Plant, Ridgway, Pa.

RO-3

The New York State Power Authority's

NIAGARA POWER PROJECT

Uses only De Laval Centrifugals for Insulating Oil Purification



At Lewiston:
A 1,200 gal/hr
De Laval Model 84-36
for insulating oil purification
Two 300 gal/hr
De Laval Model 65-36's
for lube oil purification

At Tuscarora:
A 1,200 gal/hr
De Laval Model 84-36
for insulating oil purification
Two 300 gal/hr
De Laval Model 65-36's
for lube oil purification

At the Switchyard:
Two 1,800 gal/hr
De Laval Model 94-36's
for insulating oil purification
A 1,200 gal/hr
De Laval Model 84-36P
for portable
insulating oil purification

These oil circuit breakers are typical of the installations served by the portable De Laval #65-36 Oil Purifier.

Maximum security with minimum maintenance sums up the reason for the 9 De Laval installations at the Niagara Power Project. They remove water and solids quickly, efficiently and continually. All types of oils, including synthetics, are purified without removal of additives.

Centrifugal purifiers or complete centrifugal systems for your power generation or power transmission units are available from De Laval. We can help you in the choice of an optimum system for each application.

DE LAVAL

THE DE LAVAL SEPARATOR COMPANY
Poughkeepsie, New York or
5724 N. Pulaski, Chicago 46, Illinois

DE LAVAL PACIFIC COMPANY
201 E. Millbrae Avenue, Millbrae, Calif.

HOW MARKET SURVEYS CAN HELP DEALERS SELL

Utility survey provides dealers with factual up-to-date saturation figures on appliances and permits pinpointing markets to local level where potential is great. All survey costs are recovered within six months.

By HOWARD B. HICKS
Residential & Rural Sales Manager
Carolina Power & Light Company

A RECENT appliance survey conducted by Carolina Power & Light Company has enabled appliance dealers in the area to understand why the Company emphasizes many loadbuilding programs on low-saturation items. It showed the dealer how to spend his promotional dollars wisely on the most likely items and made it easier for the Company to plan loadbuilding programs that fit the particular area.

Although the survey was not a cure-all for every loadbuilding problem, it served a useful purpose.

1. The Company uncovered evidence that a tremendous market for electrical appliances still existed in its service area.
2. The dealer realized that the survey could serve no worthwhile purpose for Carolina Power & Light Company unless, and until, he profited first through the sale of more merchandise.
3. It encouraged a closer working relationship between dealers and company sales personnel.

Dealer Sales Important

Whether utilities merchandise or not, all rely on dealer sales to some extent in their loadbuilding programs. I have observed a number of things that utilities are now doing to solicit the support and active participation of dealers in appliance merchandising. These include advertising support, dealer training, home-service assistance, providing sales tips, conducting campaigns, contests, subsidies, and market studies.

Outdated Information

In the latter part of 1957 as we began to plan our residential activity for 1958, we realized that our information on customer acceptance of our service was outdated. This came about because a vast amount of electrical merchandise is shipped into our area from chain stores, discount houses and other outlets that do not furnish us a report of their sales.

The appliance dealers in our area were actively advertising and promoting electrical appliances but oftentimes when we were promoting ranges the dealers were pushing home laundry equipment or some other service.

Dealers Are Uninformed

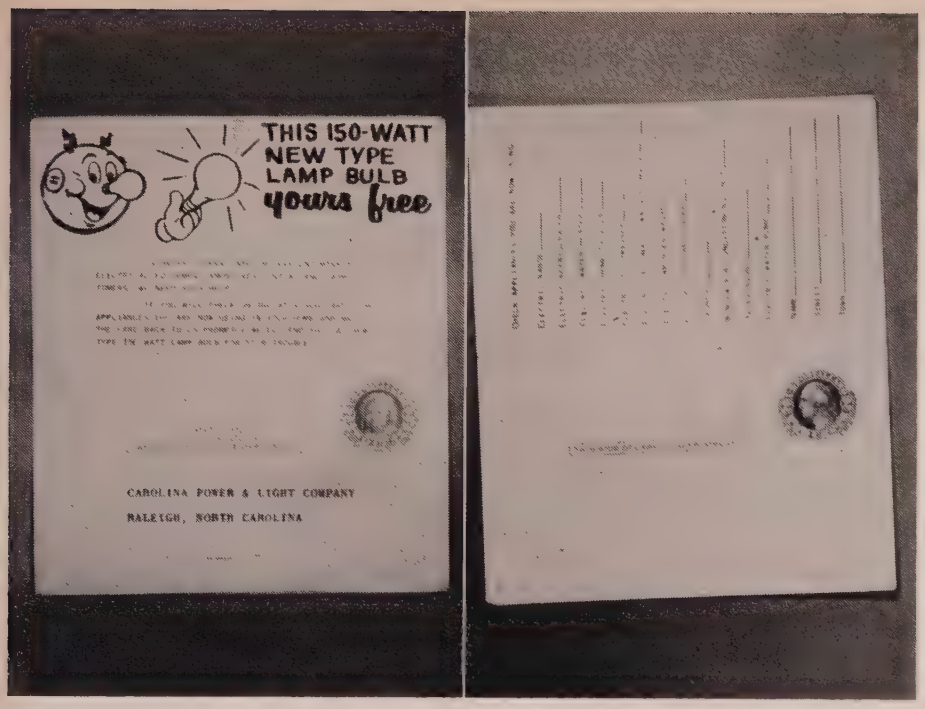
We called on several key dealers to determine whether or not they had accurate knowledge of the appliance market. We asked such questions as: Who are your appliance prospects? Where are your appliance prospects? What do they buy? Why do they buy? The dealers' failure to come up with the answers to these questions led us to the conclusion that it would be difficult for the dealer to co-ordinate his appliance merchandising with our program unless we both were working from the same information and toward the same common objective. Only 15% of our dealers are handling electrical appliances exclusively. The other 85% sell appliances along with furniture, hardware, etc. It was obvious that a majority of the dealers would not have the interest, time or money necessary to conduct their own market research. We decided that this was a job we should undertake.

We first considered using an outside agency to conduct this study, but abandoned this idea because of cost and other considerations. We next thought about using our own personnel in a door-to-door survey with customers. While this method no doubt would have been quite satisfactory, it would have taken our sales personnel away from their regular assignment and the final results would not have been as conclusive.

Someone suggested that point-of-sale interviews be made to determine trends. This would not have been expensive but we were of the opinion that the results in this case, too, would not have been accurate.

Sampling Survey Used

We finally decided that some form of a sampling survey should



Survey card was mailed to 33,944 residential and rural customers. Return was 50.8% in one month.

be used. We debated for a long time about whether to take a large sample or a small one. To be on the safe side, we chose a large sample because we wanted the results to be representative of all customers. We prepared a double-post-card survey form. We offered the customer a 150-w lamp bulb provided the survey form was completely filled out and returned. The card which was addressed to the customer carried the following copy:

"In order to evaluate the present market for electrical equipment among residential and farm customers, we need your help.

"If you will check on the attached card the appliances you are now using in your home and mail the card back to us promptly, we will send you a new-type 150-w lamp bulb in exchange for your trouble."

On the reverse side of the post card, we had the following:

Check the appliances you are now using:

Electric range _____
Electric refrigerator _____
Electric water heater _____
Electric home freezer _____
Electric dishwasher _____
Electric automatic washing machine _____
Electric wringer washer _____
Electric clothes dryer _____
roner _____
Window air conditioner _____
Television _____
Electric water pump _____
Name _____
Street _____
Town _____

This survey card was mailed to every tenth residential and rural customer without respect for race, color, income or location. A total of 33,944 cards was mailed. As these cards were returned to the general office, lamp bulbs were mailed directly to each customer answering the survey. In one month's time, 17,256 cards were returned, which was 50.8%. Since then we have had several thousand other cards come in. We tabulated the results as the cards were being returned and found that the information stabilized itself after a 2% return.

Door-To-Door Survey

To check the accuracy of the post-card survey, we picked a town and, using our own personnel, made an actual door-to-door survey. In comparing the results of the post-card survey of this town with the door-to-door survey, we found the results of the post-card survey were accurate to within 5%. This accuracy was far better than we had anticipated.

In checking the survey returns, it was encouraging to note many favorable comments from customers. There were, however, a few complaints. Every complaint was followed up with a personal call. This gave us an opportunity to handle situations that otherwise might not have come to our attention.

When the survey was completed, we had factual up-to-date saturation figures on ranges, refrigerators, water heaters, freezers, washers, dishwashers, air conditioners and TV sets. The survey confirmed fairly well our knowledge of range and water heater saturation but the information on freezers, clothes dryers, automatic washing machines, air conditioners and televisions, was completely new. From the survey we were able to study saturation for the system as a whole and pinpoint markets right down to a local level so that we knew the areas where our service was being used freely and likewise the areas where market potential was great. We were, then, in position to plan a sales program that would be applicable to both the unsold and the replacement market for every part of our service area.

Presenting Results

The results from this survey were presented to sales allies through a series of 11 dinner meetings with dealers and distributors. We felt that through a personal presentation, we could establish in the dealers' mind that the market for electrical appliances was profitable. We wanted to give the dealers

a chance to ask questions about the survey, also. We thought, too, that the dealer was interested in sales information, so our presentation was built around a combination of market and sales facts. Since this was our golden anniversary, we built our program around the theme, "In 1958 C. P. & L. Area is a Gold Mine of Sales for the Appliance Dealer."

The following is an actual presentation of this survey just as it was given to the dealers:

1. "Twenty-eight percent of our customers do not enjoy the benefit of electric cooking and at least 9,000 customers will replace their old electric range, too. To get your share of this business, we suggest you sell these electric range features: Modern, automatic, dependable—accurate, clean, economical, safe—flameless, fast."

2. "The electric refrigerator has been promoted for a longer period of time than any other single appliance other than the electric iron, so it is natural that the saturation on refrigerators is high. Two and three-tenths percent of our customers do not own refrigerators but the replacement market is approximately 12,000 per year. A two-temperature model means more profit for the dealer. These electric refrigerator features should be stressed to make more sales: More frozen-food storage space, new design with color, automatic defrosting, more convenient arrangement for food storage, add a second refrigerator for bulky food storage."

3. "Thirty-nine percent of our customers need to know about the dependable, automatic electric hot water service. Electric water heaters are no longer a luxury but are a necessity. The popularity of automatic washing machines and dishwashers has created new hot-water demands. The selling features of the electric water heater are: Completely automatic; carefree maintenance; clean; can be placed anywhere—no fumes, no flames, no soot; no vents; safe; dependable and modern."

4. "Seventy percent of our customers do not enjoy the leisure of freezer living. Today's suburban living calls for fewer trips for groceries, less meal preparation time and a greater variety of foods from which to choose. Let's sell these features: Convenient, time saving, money saving, housewife can plan meals ahead, easiest method of food processing, and always a variety of foods—meats, poultry, fish, fruits and vegetables."

5. "Ninety-five percent of our customers are ripe for a dishwasher. Every new home builder should be a good prospect for the electric dishwasher. Its installation can be made at low cost during the building period. Some selling features for the dishwasher are: Dishes and glassware hygienically cleaned—reducing the spread of germs; ends dishwashing, scraping, stacking and drying; gives more time for other things; modern."

6. "The saturation for automatic and conventional washers is 38 percent each which indicates there is a tremendous market for automatic washing machines both in the new and replacement market. Some of the automatic washer features are: Completely automatic—set it and forget it; convenient—wash anytime, no wet clothes to handle; modern styling with color; superior washing results every time; fewer washables necessary because of the ease and frequency of washing; safe—no mechanical hazards involved—will not harm delicate fabrics."

7. "Ninety-six and one-half percent of our customers are hot prospects for electric clothes dryers. A vast amount of education, demonstration and hard selling will be necessary to change this picture. This can be accomplished through selling these dryer features: Convenient—dry clothes anytime regardless of weather; less back-breaking handling of clothes; no trips outdoors in disagreeable weather; safe—eliminates outdoor hazards; clothes are fluffier and softer—less ironing required; laundry area stays clean and dry; conditions clothes for easier handling and storage; saves time, steps and effort; economical operation—approximately 7¢ a load; modern."

8. "Eighty-seven percent of our customers will be interested in air-conditioners. The packaged window airconditioning unit is an economical answer to summer discomfort! Modern homemakers rapidly are discovering that airconditioning is here to stay. The selling features for the room airconditioner are: Cool comfort for living, working, sleeping and recreation; filtered pollen-free air; dehumidification; economical—cools only required area; reasonable operating cost; low maintenance; conserves space; flexible—airconditioning can be added a room at a time; thermostatically-controlled temperatures; modern."

9. "Surprisingly, 24½ percent of our customers still are without television. Many replacement sets plus second TV sets will be sold. Television provides these features: Inexpensive entertainment; educational—news and public service features; saves money that would be spent on other forms of entertainment; develops greater home and family ties; sets priced for every budget."

Cost Was Liquidated

Now, one question naturally suggests itself: "How much did it cost?" The total cost was $6100 but if we assume that each 150-w lamp mailed to customers replaced a 60-w lamp, the revenue gained from the additional wattage liquidated the expense within less than six months.

Through distributor reports of shipments into our area, we are keeping saturation and market potential figures to date; however, we propose to repeat this type of survey every five years.

Summary of plans and results of the survey.

- 150 WATT LAMP OFFERED FREE
- SENT TO EVERY 10th RES. & RURAL CUSTOMER
- TOTAL OF 53,944 CARDS SENT OUT
- 17,256 CARDS RETURNED—50.8%
- SURVEY STABILIZED AFTER 2% RETURN
- RESULTS VERIFIED—ACCURACY 5%
- TOTAL COSTS $6,100
- ALL COSTS RECOVERED WITHIN 6 MONTHS

More Transmission Lines for Idaho Power

While Idaho Power has turned into the homestretch on construction of Oxbow Dam, second unit in its new three-dam development on the Snake River bordering Idaho and Oregon, it is lacing the land with new transmission lines as part of the program. Four are complete, and a fifth is under construction.

First of the new lines was a 230-kv carrier between Brownlee and Baker, Oregon. Forty-two miles long, it is a multiple-pole line requiring some 300 Douglas Fir double crossarms. Next came two 230-kv all-steel lines —Brownlee-Boise line, 100 miles long, and the Brownlee-Oxbow line, ten miles long. Also finished is Idaho Power's 66-mile portion of a fourth line that extends 108 miles northward from Oxbow to interconnect with the systems of Washington Water Power and Pacific Power & Light. Washington Water Power is building the other 42 miles of the new carrier.

Steel towers support 20 miles of Idaho Power's section of the 230-kv line, with wood towers of H-frame design supporting the remaining 46 miles. Some 200 Douglas Fir 4 in. x 10 in. double crossarms were used for the wood-tower section.

Even more Douglas Fir 4 in. x 10 in. crossarms—about 1500—will go into Idaho Power's fifth new line.

Hold-down assembly erected by Idaho Power to keep conductors from floating shows some of the construction problems encountered in running this line from Oxbow Dam to systems of Washington Water Power and Pacific Power & Light.

Graphic history of electric metering is provided by this meter display maintained by Ohio Edison at Akron. Several dozen meters, some of them first used in the 80's, are mounted here in Ohio Edison's Central Electric Laboratory. Founder of the collection is General Meter Supervisor H. H. Koch (right) who started it more than 30 years ago. Here Mr. Koch and Laboratory Supervisor R. W. Drushel examine a large self-contained meter of the type used briefly at the turn of the century. This meter could measure either a-c or d-c, but proved too expensive and easily damaged. Many of the meters collected by Mr. Koch came from the basements, attics and old storage rooms of early electric customers.

Utilities Next to Police In Two Way Radio

Next to the police, the United States' electric and gas utilities are the greatest users of two-way land radio. Two-way radio is to the point where more than 125,000 transmitters are now in operation in the utility field, Bruce W. Conover, of South Jersey Gas Co., told the Summer General Meeting of the American Institute of Electrical Engineers.

Transistorized radios, recently installed at a 33-percent greater cost than the tube types, save a grand total of $106.20 each annually in maintenance and operation, he asserted.

Mr. Conover said the estimated savings were the result of smaller size, lower power drain, elimination of the need for keeping car motors idling while the radios were on, and higher trade-in value. Another benefit he listed is the increased audio power. He said that the efficiency of the new radios is so good that dispatchers can identify them over older sets.

PEAK-LOAD ENERGY AT LOW INCREMENTAL COST

Installation of peaking capability in a high-efficiency reheat unit offers attractive possibilities.

By F. A. RITCHINGS
Consulting Mechanical Engineer
and
R. R. BENNETT
Mechanical Engineer
Ebasco Services Incorporated

MANY UTILITY SYSTEMS may now be entering an era in which units are selected for particular load service. There are several means by which capacity can be added to a system to accomplish this end and they include:

1. High-efficiency base-load unit.
2. Low-cost and relatively low-efficiency nonreheat unit which would fit well above the mid-point of a utility's loading curve, i.e., not base-loaded because of poorer efficiency than some units in the system and not at the peak of the curve as presumably there are older less-efficient units available for this service.
3. Incremental-capacity units which are essentially base-load high-efficiency units with the ability to produce peaking capability at low incremental cost.
4. Peak-load units such as diesel, pumped-hydro storage or gas turbine.

Many excellent papers have been written on the use of low-cost nonreheat steam turbines, diesels, gas turbines and pumped-hydro installations to serve essentially peak-load requirements. The intent here is to discuss several alternative methods by which incremental peaking capacity may be built into an efficient base-load unit.

Since at present the foreseeable future does not offer any significant reduction in heat rate without a substantial increase in investment, the economic solution for systems that already have a high proportion of their production facilities in modern, efficient reheat units would be to schedule installation of new units in a manner which would keep the present reheat units in the lower portion of the load-duration curve for a longer period of time. The economic desirability of this type of planning is illustrated in Figs. 1 and 2.

Typical System Conditions

Figure 1 shows a typical load-duration curve for a system having an annual load factor of 63 percent. It is noted that the base load is only 30 percent of the peak. Thus 70 percent of the system generating capacity can be classified as either intermediate or peak-load capacity. If it is assumed that system firm generating capacity is equal to peak-load requirements and for this discussion consideration is not given to spinning reserve and area-protection requirements, then in the peak, 25 percent of the firm capacity is required in service 40 percent of the time, 10 percent only about three percent of the time and five percent only one percent of the time. Thus, a very significant percentage of installed capacity is required to serve loads of very short duration.

The corresponding energy production for this theoretical system is shown on the load-energy curve in Fig. 2. It is interesting to note the small amount of energy generated by the capacity required to serve the peak. The top 10 percent of the capacity produces less than 0.2 percent of the total energy. In fact, the top 25 percent of the capacity produces less than five percent of the annual total energy.

Figure 3 illustrates the incremental cost of energy production as related to peak-load. As the load increases the cost of energy production for the increment of load added also increases. Due to the few hours of operation at high system loads, the fixed charges on production-plant investment for energy production in the peak are many times more significant than the cost of operating labor, maintenance and fuel.

The cost of providing capacity to meet the increase in peak demand is further aggravated by the continuing inflationary trend resulting in a current increase in the installed cost of production facilities in the neighborhood of 2½ to 3 percent per year compounded.

Many systems have a much lower load factor than the 63 percent figure used herein. Also it is obvious

that the lower the system load factor the more pronounced these conditions become. In general, system load factor is not increasing—in fact on many systems it is progressively decreasing. Considerable effort continues to be expended to find ways of increasing load factor but to date this effort has not met with significant success in most areas.

Incremental-Capacity Unit

A review of the cost of capacity to serve the loads other than the base indicates attractive economic possibilities for an "incremental-capacity" unit. While it is appreciated that the peaking capacity made available by this unit will not satisfy all the peak-load requirements it is believed that the possible low installed cost per kilowatt of such capacity cannot be overlooked. All of the methods are not at present considered practical by all of the manufacturers; however, discussions with them indicate that the equipment required by each method can be built today. As the need develops, further study and ingenuity will no doubt bring forth even more attractive ideas.

Each of the schemes described hereafter, except one, provides for "shifting" from normal unit capacity to maximum design peaking capacity without a start-up time interval and without the need for additional operating labor. Each scheme provides capacity for peaking at lower investment per installed kilowatt than the "base" cost.

The basic unit for this comparison is a TC3F unit with a maximum capability of 250 mw and throttle-steam conditions of 2000 psig 1000 F/1000 F reheat. Several alternative means by which additional capacity could be built into such a unit were studied and each alternative method was reviewed with several major equipment manufacturers.

The base 250-mw TC3F unit includes a generator with a capability of 292 mva, 0.90 power factor, 0.64 scr at maximum hydrogen pressure. The cycle is conventional with seven extraction heaters and requires a throttle flow of 1,715,000 lb/hr and a reheat flow of 1,559,000 lb/hr to produce 250 mw at 3½-in. back-pressure, which is a typical summer peak back pressure in the

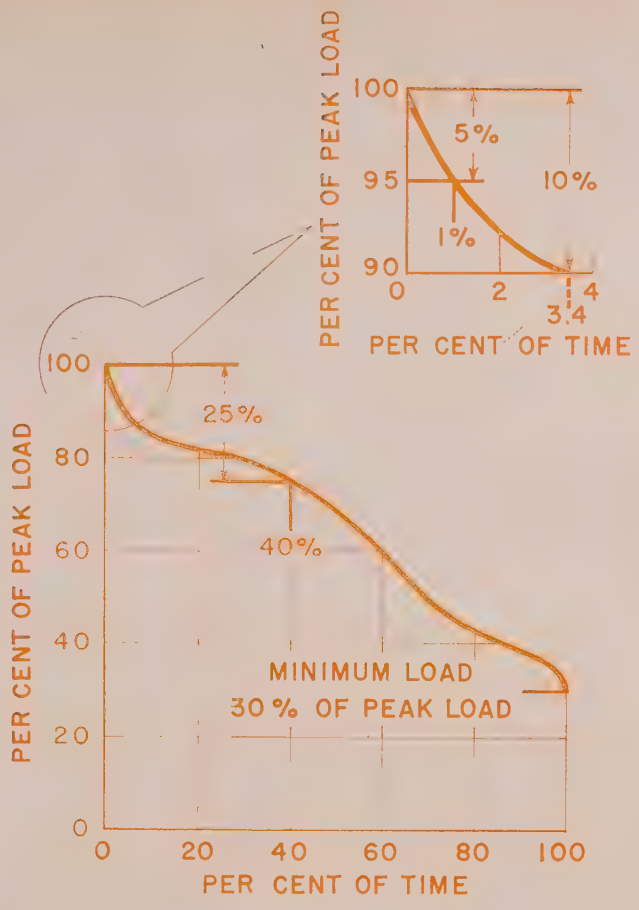
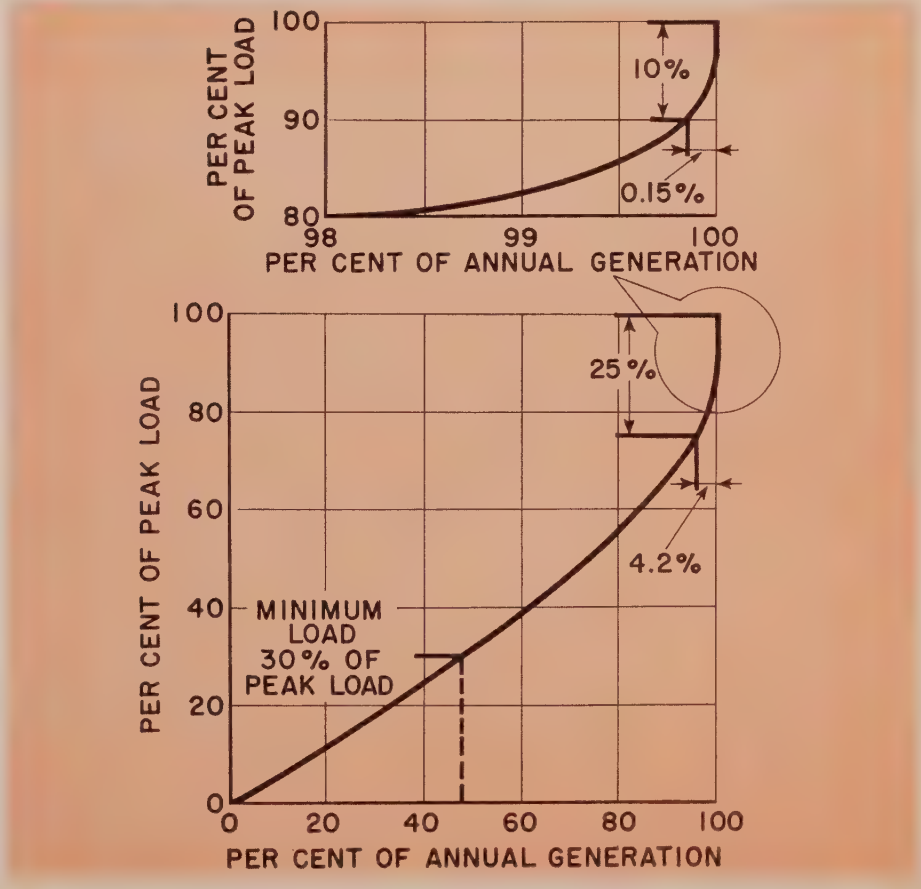


Fig. 1—Load-duration curve (63 percent annual load factor)

Fig. 2—Annual load-energy curve (63 percent load factor)



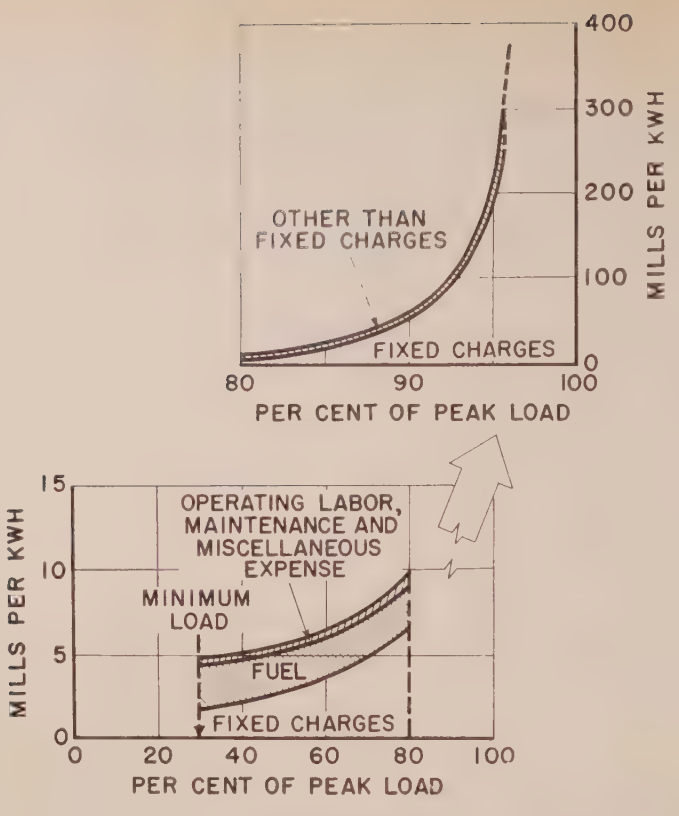


Fig. 3—Production cost (including fixed charges on investment)

South. The estimated net station heat rate is 10,058 Btu/kwh with gas firing. This reheat unit is strictly conventional without peaking capabilities; however, modifications may be made to the equipment to provide added capacity for use at the time of system peak. This added capacity would be achieved at some increased cost and with varying degrees of degradation of heat rate.

Modification of Base Unit

For each of the methods studied to achieve "peaking" capacity over and above the normal rating of 250 mw at 3½-in. back pressure and with normal steam conditions of 2000 psi 1000 F/1000 F, no increase in the size of condenser or extraction heaters is assumed and no increase in size of piping is provided except where an uneconomic drum-design pressure would result due to excessive pressure drop between boiler and turbine. Design of the turbine and generator, steam generator, boiler-feed and condensate pumps, transformer and auxiliary electrical equipment are modified as required, and where necessary, design pressure is increased for piping, heaters and other equipment. Thus, in each case, an attempt is made to achieve the incremental peaking capacity with minimum added investment over that required for a normal 250-mw unit, accepting whatever back-pressure and net station heat rate resulted at maximum capability since fuel cost is relatively insignificant as compared to fixed charges for the little energy generated on peak.

Modifications are required to the steam path of the turbine in order to permit operation at higher flows and, in some cases, at higher pressures in order to obtain "peaking" capacity.

As previously mentioned, not all of the turbine-generator manufacturers agree that all of the schemes considered are practical because the exhaust loading exceeds the limit of 13,000-14,000 lb/hr/sq ft of annulus area set by some designers even though this loading is imposed at a high back-pressure. This high exhaust loading occurs because a TC3F unit is selected to be modified to provide the incremental peaking capacity. If for a specific situation the high exhaust-flow loading for the size of units discussed here is not recommended by the manufacturer, it may be necessary either to reduce the peak load or to use a TC4F design. For all units described this design change would increase the investment, at today's price levels, about $600,000 which would be additive to the cost of incremental capacity for each scheme.

The generator for each scheme is selected on the basis of normal maximum hydrogen pressure. None of the turbine-generator manufacturers, at present, recommend increasing the normal maximum hydrogen pressure for which their equipment is designed and all strenuously recommend against operation of the generator at higher than normal temperature levels. Thus, for each of the schemes described, a larger generator is required than would be furnished for a 250-mw unit.

Modifications to the steam-generator unit are required to provide for the additional steam flow required by the various alternatives. Increase in steam flow is accompanied by both a 15 to 30 percent higher furnace heat release at peak loads and by widening the furnace when necessary. For each scheme described, the steam-generator efficiency is the same at 250-mw as for the base "non-peaking" 250-mw unit; however, no attempt is made to maintain the same efficiency at the peak capacity. At the peak capacity the steam-generator efficiency is estimated to be reduced by about two to three percent. The amount of superheater and reheater surface is varied to meet the requirements of the various alternatives. The ability of the unit to maintain constant superheat and reheat temperatures at loads below 250-mw would be impaired in some of the peaking schemes. Those schemes which specify operation at 2400 psi for peaking would require a steam drum and all other pressure parts with sufficient wall thickness for the higher pressure.

In the case of a coal-fired system where coal is also used for peaking, pulverizer capacity would not be added for the peaking schemes until the pulverizer margins are used up by the requirements of a particular scheme for additional fuel. It is also assumed that at 250-mw, there is a spare pulverizer but that at peak load the spare mill is in service. This, of course, requires proper scheduling of pulverizer maintenance.

Two half-capacity boiler-feed and two half-capacity condensate pumps are used for the base unit. This same pump arrangement is used for

the alternative units with the pump heads and capacities adjusted to meet the requirements.

In general, peaking capacity is achieved in this study by modifying equipment only to the extent required and by encroaching on normal design margins so that all equipment is essentially "wide open" when developing peak-load.

The "incremental-peaking" unit will be operated probably at its maximum peaking capacity for relatively few hours per year and generally only during those hours each day of the peak-load season that the incremental capability is required to meet system demands. Operation at maximum peaking capability will encroach on the design margins of the equipment, and prolonged operation under that condition could increase maintenance requirements over the years and possibly shorten the useful life of the equipment. For coal or oil firing, the increased gas temperatures and velocities could, with prolonged operation, cause an increase in ash and slag accumulation throughout the unit and an increase in tube erosion.

Alternative Peaking Schemes

1. *Increased Throttle Pressure* — Study was made of the effect of increasing throttle pressure 400 psi, instead of the usual five percent, or about as high as can be achieved with a natural-circulation boiler. Coincident with this pressure increase, the superheat and reheat steam temperature is reduced from 1000 F to 950 F so as to avoid the necessity of incorporating superior alloys in the superheater and reheater sections of the steam generator. The steam temperature reduction permits higher mass flow of gas through the superheater and reheater sections without raising the average metal temperatures higher than are obtained under normal 250-mw load conditions at 1000 F steam temperature. The selection of 950 F is arbitrary for this study —a specific steam-generator design may require a lower or higher steam temperature at the overpressure condition. The crossover heater and high-pressure heater are removed from service thereby resulting in a lower feed temperature to the steam generator and increasing the reheater flow to be about equal to the throttle flow—the difference indicated being that due to gland steam leakage.

The 2,139,000-lb/hr throttle flow in this scheme was selected since it is volumetrically the same as the 1,715,000-lb/hr flow at 2000 psi 1000 F for the base "non-peaking" 250-mw unit.

These modifications provide for 314-mw gross capability at 4.5-in. back pressure and a net station heat rate of 10,830 Btu per kwh with gas firing.

An arrangement was considered similar to the foregoing but with the four lowest-pressure heaters taken out of service in addition to the two highest-pressure heaters leaving the deaerator as the only feedwater heater. This arrangement at the 2,139,000-lb/hr throttle flow would result in a poorer heat rate and, therefore, a lesser capability. Consequently no further consideration was given to this arrangement.

2. *Increased Throttle Pressure (All Heaters Out)*—By removing all heaters from service about 335-mw can be achieved at 5.8-in. back pressure if the equipment is designed to permit increasing the throttle pressure to 2400 psi and reducing throttle-steam and reheat temperature to 950 F and hence passing a throttle flow of 2,139,000-lb/hr as described before. A separately-fired economizer is installed to heat feedwater to 250 F. This is the only scheme that involves placing additional equipment into service to develop unit maximum capacity. The net station heat rate is 12,300 Btu/kwh with gas firing.

3. *Steam Bypass of High-Pressure Turbine*—This scheme requires a steam generator which will deliver 2,779,000-lb/hr at the superheater outlet. The normal throttle flow of 1,715,000-lb/hr required for 250-

Table I

SUMMARY OF OPERATING CONDITIONS

Scheme		A	B	C	D	E	F	G
Figure Number		6	7	8	9	10	11	12
Description		Base Unit—No Peak	Throttle Pressure Increased—Temperature Decreased—2 Top Heaters Out of Service	Throttle Pressure Increased—Temperature Decreased—All Heaters Out of Serv.—Separ. Fired Economizer	Steam Bypassed from Superheater Outlet to IP Turbine Inlet—Top Heater Out of Service	Steam Bypassed from Primary Superheater Header to Reheater Inlet—Top Heater Out of Service	Same as Scheme E Except Throttle Pressure Increased and Temperature Decreased	Spray at Reheater Inlet to Within 25F of Saturation—Top Heater Out of Service
Maximum Capability	mw	250	314	335	350	350	350	286
Throttle Pressure	psig	2,000	2,400	2,400	2,000	2,000	2,400	2,000
Throttle Temperature	F	1,000	950	950	1,000	1,000	950	1,000
Reheat Temperature	F	1,000	950	950	977	1,000	950	1,000
Throttle Flow	K lb/hr	1,715	2,139	2,139	1,715	1,715	2,139	1,715
Reheat Flow	K lb/hr	1,559	2,120	2,120	2,764	2,713	2,678	1,995
Extraction Flow to Crossover Heater	K lb/hr	141	0	0	0	0	0	0
Reheater Inlet Pressure	psig	553	761	761	998	979	965	715
Reheater Inlet Tempearture	F	681	673	673	833	761	718	532
Feedwater Temp to Steam Generator	F	479	387	250	462	460	459	431
Exhaust Flow	Million lb/hr	1,205	1,655	2,120	1,991	1,966	1,929	1,502
Condenser Duty	Million lb/hr	1,150	1,526	1,983	1,835	1,825	1,768	1,423
Exhaust Loading	lb/hr/sq ft	9,773	13,423	17,194	16,160	16,150	15,650	12,182
Leaving Loss	Btu/lb	6.4	6.3	6.6	7.0	6.9	6.7	6.6
Back Pressure	in. Hg abs	3.5	4.5	5.8	5.0	5.0	5.0	4.0
Gross Turbine Heat Rate	Btu/kwh	8,025	8,337	9,467	8,845	8,623	8,466	8,400
Net Station Heat Rate—Coal	Btu/kwh	9,755	10,490	11,905	11,250	10,830	10,640	10,200
Net Station Heat Rate—Gas	Btu/kwh	10,058	10,830	12,300	11,620	11,190	10,990	10,516

Table II

DIFFERENTIAL INVESTMENT ESTIMATES

Scheme	A	B	C	D	E	F	G
Figure Number	6	7	8	9	10	11	12
Description	Base Unit—No Peak	Throttle Pressure Increased—Temperature Decreased—2 Top Heaters Out of Service	Throttle Pressure Increased—Temperature Decreased—All Heaters Out of Serv.—Separ. Fired Economizer	Steam Bypassed from Superheater Outlet to IP Turbine Inlet—Top Heater Out of Service	Steam Bypassed from Primary Superheater Header to Reheater Inlet—Top Heater Out of Service	Same as Scheme E Except Throttle Pressure Increased and Temperature Decreased	Spray at Reheater Inlet to Within 25F of Saturation—Top Heater Out of Service
Turbine Generator Unit and Accessories	Base	$ 914,000	$1,060,000	$1,660,000	$1,819,000	$1,307,000	$ 734,000
Steam Generating Unit—Gas Fired—Including Separate Fired Economizer	Base	500,000	1,290,000	1,020,000	800,000	1,000,000	350,000
Boiler Feed and Condensate Pumps	Base	44,000	38,000	77,000	73,000	93,000	17,000
Extraction Feedwater Heaters	Base	19,000	Base	35,000	35,000	39,000	Base
Piping and Valving	Base	22,000	22,000	128,000	63,000	80,000	41,000
Main and Auxiliary Power Transformers	Base	36,000	48,000	60,000	60,000	60,000	10,000
Auxiliary Electrical Equipment	Base	173,000	229,000	261,000	315,000	342,000	121,000
Indirect and Overheat Construction Costs	Base	182,000	293,000	359,000	335,000	329,000	147,000
Total Construction Costs	Base	1,890,000	2,980,000	3,600,000	3,500,000	3,250,000	1,420,000
Capability—Mw	250	314	335	350	350	350	286
Cost per kw for Base 250 mw—Gas Firing	102						
Incremental cost/kw for Capability above 250mw—Gas Firing for Peak	—	29.50	35.00	36.00	35.00	32.50	39.50
Cost per kw for Base 250 mw—Coal Firing	122						
Incremental cost/kw for Capability above 250 mw—Coal Firing for Peak	—	35.50	38.50	40.00	40.50	37.00	39.50
Cost per kw for Base 250 mw—Coal Firing	122						
Incremental cost/kw for Capability above 250 mw—Oil Firing for Peak	—	33.00	35.00	36.50	37.50	33.00	41.00

mw would pass into the high-pressure turbine at 2000 psi 1000 F. Over 1,000,000-lb/hr would be bypassed from the main steam piping through a reducing valve to the reheat turbine section inlet at an average steam temperature of 977 F at the reheat turbine inlet. This flow was selected to achieve 350-mw generation. The crossover or highest pressure heater is removed from service. At the gross generation of 350-mw and a back pressure of 5.0 in., the net station heat rate is 11,620 Btu/kwh on gas firing. This arrangement substantially increases the flow through the superheater over that flow required for 250-mw gross but does not affect the flow through the reheater. Some change to the high-pressure section of the "non-peaking" 250-mw unit is required because of the 450-psi increase in the extraction or exhaust pressure.

4. *Partially Superheated Steam to Reheater*—This scheme is similar to the preceding one insofar as the turbine is concerned but entirely different in the steam generator. This arrangement requires bypassing partially superheated steam to the steam-generator reheater inlet through a reducing valve so that the steam flow through the low-temperature section of the superheater is substantially increased over the flow required for 250-mw gross generation. The flow through the high-temperature superheater section is not increased. The flow through the entire reheater section is greatly increased over that required for 250-mw whereas in the high-temperature, high-pressure reducing valve arrangement of the preceding scheme it was not. As in the preceding scheme the high-pressure turbine section must be modified from that required for the 250-mw "non-peaking" unit.

The throttle and reheat steam temperatures are both maintained at 1000 F and the throttle pressure maintained at 2000 psi during peaking operation. The flows were selected to provide 350-mw gross at 5.0-in. Hg back pressure. The net station heat rate is 11,190 Btu/kwh with gas firing.

5. *Previous Scheme With Increased Throttle Pressure*—This is a scheme similar to the preceding scheme except that the throttle pressure is raised to 2400 psi and the throttle and reheat temperatures are reduced to 950 F, thus increasing throttle flow to 2,139,000-lb/hr as described for some of the preceding schemes. These changes in throttle conditions reduce the amount of partially superheated steam bypassed to the steam-generator reheater inlet to achieve 350-mw. At 350-mw, the back pressure is 5.0-in. Hg and the net station heat rate is 10,990 Btu/kwh with gas firing.

6. *Spray at Reheater Inlet*—The preceding methods have each resulted in capability at the time of system peak of 314 to 350 mw. Another method achieves a nominal increase in capacity—from 250-mw normal to 286-mw—by the simple expedient of spraying feedwater into the steam-generator reheater inlet to reduce the steam temperature to within about 25 F of saturation and by removing the crossover heater from service. The net station heat rate at a back pressure of 4.0-in. is 10,516 Btu/kwh on gas firing. The characteristics and the design margins built into existing units may permit the adoption of this idea to some degree on present equipment. This is the simplest of all arrangements studied, but it does result in the smallest increment of peaking capacity.

Summary

Table I describes each of the incremental peaking capacity schemes briefly and summarizes for each scheme and the basic 250-mw unit, the peak capacity, steam flows, back

(Continued on page 88)

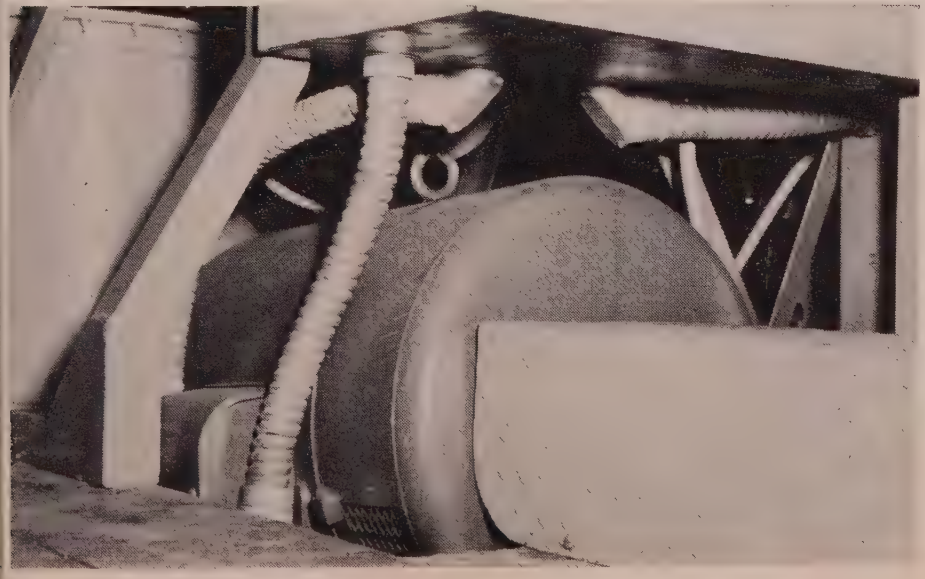
VERSATILE MOBILE TEST TRUCK SAVES $5000 PER YEAR

Mobile test truck with self-contained voltage supply expedites cable testing and fault location.

By W. A. SINCLAIR
General Supervisor—Cable Operation
Electrical System
The Detroit Edison Company
Detroit, Michigan

Fig. 1—Practically a self-contained cable-testing laboratory, metro-type truck is still small enough to get close-in to test locations.

Fig. 2—Power take-off from truck engine drives self-contained testing power supply generator.



PROCUREMENT of a mobile test truck containing its own power supply has resulted in many operational economic plusses." Some of the more important gains are:

1. Annual savings of at least $5000. Need for installing a temporary 220-v source is eliminated.
2. Safer working conditions. Smaller in size, the test truck may be positioned closer to cable terminations than was possible with the larger trucks. In some cases this eliminates the need for a test man whose main assignment was to act as a safety man when it was necessary to have long runs of high-voltage test leads.
3. Better public relations. This is especially true when the Cable Test group is requested by the Sales Department to locate cable faults on customers' premises.
4. Greater flexibility in field testing and fault location.

Mobile test trucks have been used by The Detroit Edison Company for a number of years for cable testing and fault-location, but they have had limitations. Their size made them difficult to maneuver in the downtown area and at customers'

primary rooms, and they required a 220-v source with sufficient capacity to operate the equipment.

Thus, long runs of high-voltage test leads were exposed, requiring an extra man to provide the necessary safety protection in many cases.

At times a 220-v source with sufficient capacity to operate the equipment has been difficult and expensive to obtain. It has been necessary to request the Overhead Lines Department or customer to install a transformer to provide a source for the test equipment. In some cases, temporary overhead primary installation has been necessary.

To overcome limitations of the existing equipment, engineers of the Cable Test group designed and supervised the building of a small test truck with a self-contained voltage supply.

A metro-type truck shown in Fig. 1 was used.

Equipment in the truck and truck frame is connected solidly to a copper ground bus. Two metal reels connected to the ground bus house long flexible bare braided copper wire. This wire is unreeled and connected to the station ground or some other suitable ground, thus effectively grounding the truck ground bus.

220-Volt Power Supply

The equipment installed in the truck may be energized from an external 220-volt source or from its own power supply.

When a suitable external source is available, it may be brought into the truck by two long flexible rubber-covered leads which are wound on wooden reels. One end of the lead is attached to a copper flange built into the reels and the other end has large rubber-protected clips that facilitate connecting to the source.

In designing this truck, engineers made provisions to include a 20-kw, 1800 rpm, single-phase, 60-cycle, 120/240-v R-frame generator with a 1½-kw 120-volt d-c exciter which would be driven by a power take-off from the truck engine. (See Fig. 2.) Capacity of this generator is sufficient to operate the equipment in the truck or furnish input voltage for the larger test trucks when no power supply is available.

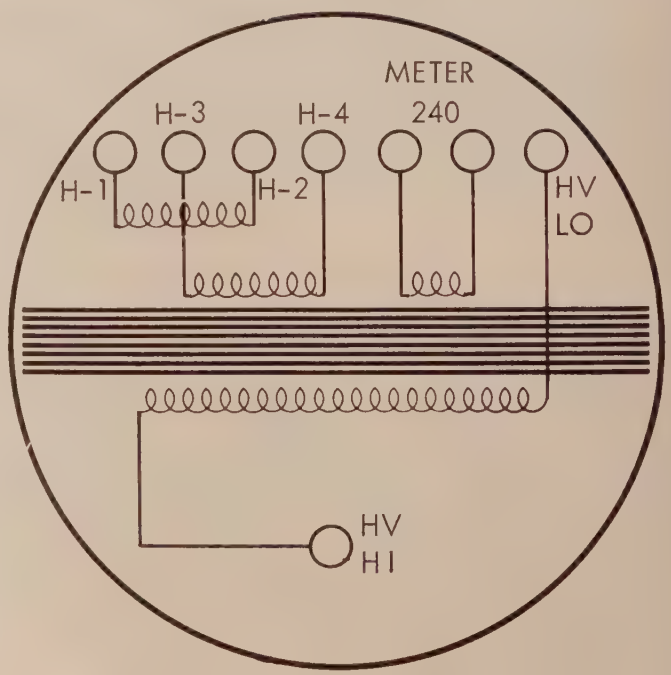
The generator control panel includes a frequency meter, a-c voltmeter 0-300 v, a-c ammeter 0-150 amps, manual field rheostat and automatic voltage regulator as shown in Fig. 3.

Kenotron Set

The kenotron set has a 50-kv rating and can supply 300 milliamperes for carbonizing cable faults. The main transformer was built to Detroit Edison specifications and has a double winding on the primary which can be paralleled for high-voltage testing and connected in series for supplying burning current. Fig. 4 shows the windings of the main transformer.

Control panel for the kenotron

Fig. 3—Generator control cabinet is mounted directly above generator.



MAIN TRANSFORMER

Fig. 4—Truck's main transformer has the following characteristics: primary wound with 2 strands of square No. 8 in parallel. Secondary wound with No. 23. Primary volts—240/480 with 4 terminals brought out. Secondary volts—36,000 at 0.4 amps. Meter winding—240 v at 0.4 amps. Ratio is 150/1.

Fig. 5—Control panel for kenotron set includes 0-300-v a-c tube filament voltmeter; two-pole filament switch; filament rheostat; 0-30 amp a-c ammeter-transformer input; 0-1, 0-10 and 0-300 milli-ammeter for measuring leakage current; paper protective gap; main breaker control; 0-70 kilo-voltmeter; and single-pole reactor shorting knife switch.

set is shown in Fig. 5.

Limited-Current Thyratron Fault Locator

Principle function of the "Limited-Current Thyratron" is to furnish signal current at definite time intervals.

A 20-kw, 6.6-amp, constant-current transformer with primary rewound for 220 v is used in conjunction with a Thyratron tube for reducing or locating cable faults. A grid-operated timing device is available which can be used to apply the rectified direct current for five seconds and off for 10 seconds. This interrupted tracing current in conjunction with a magnetic pick-up coil or probes has been very helpful in locating cable faults.

This equipment requires a 220-v supply with a capacity of 150 amps. It has been found that when the interrupted tracing current is being applied, the truck engine governor keeps the generator output frequency at 60 cycles. When the 150-amp load is applied the frequency drops one cycle and instantaneously recovers.

Surge Generator

Under certain conditions, such as cable buried directly in the ground, it is desirable to use a signal which may be detected at the ground surface. The surge signal can usually be detected on the ground surface by means of a stethescope or microphone and audio-amplifier detector. The unfaulted phases of the cable or condensers may be used to produce the energy for the surge.

Two 2800-v, 1.79-mfd condensers are installed in the truck to supply the surge when unfaulted cable phases do not exist.

The truck has a body 114-in. long by 76-in. high and 74-in. wide. Its maximum designed gross weight is 9000 lbs with a maximum gross carrying weight of 5700 lbs. Upon completion, the truck weighed 9160 lbs which was very close to designed capacity. Dual rear wheels were installed after the equipment was installed.

Placement of the equipment within the truck, as viewed through the rear doors, is shown in Fig. 6.

At the present time the Cable Operation Division has four high-voltage test trucks available for field testing. Their main use is to furnish d-c for proof-testing and fault location on cable lines. The equipment is also available to other divisions that do not have portable high-voltage test equipment. Upon request, the Cable Test group will conduct high-voltage a-c tests on switch positions, insulators, motor windings, etc.

Present practice calls for all 4.8-, 24- and 40-kv cable lines to be subjected to a high-voltage d-c test before being placed in service if:

1. They are new
2. They have been de-energized for 72 hours or more
3. Repairs have been made which require disturbing the insulation

One test crew is on call 24 hours a day to handle any proof testing or fault location after hours.

EQUIPMENT IN TRUCK

- High-voltage rectifier set consisting of:
  - Main high-voltage transformer
  - Filament transformers for rectifier tubes
  - Powerstat voltage regulator
  - Current limiting reactor
  - Ground and discharge switches
  - Switchboard and controls
  - Rectifier tube
- Limited-Current Thyratron Fault Locator
  - Converted constant-current street lighting transformer
  - Thyratron rectifier tube
  - Tube base, stand and grid-operated timer
  - Coil pickup, leads with probes and meter
- Adjustable gaps and condenser for surge generator 20-kw, 1800-rpm, single-phase, 60-cycle, 120/240-v R-frame generator
  - 1½-kw, 120-v d-c exciter
  - Control cabinet
- Power-drive from truck transmission
- Miscellaneous equipment
  - Two-way radio
  - Lockers for instrument and tube storage
  - Flares
  - Fire extinguisher and blankets
  - Leads and poles
  - Safety barriers and danger signs
  - Reels for ground and external supply leads
  - Electric space heater
  - Step-down transformer
  - Ground protective relays and safety interlocks

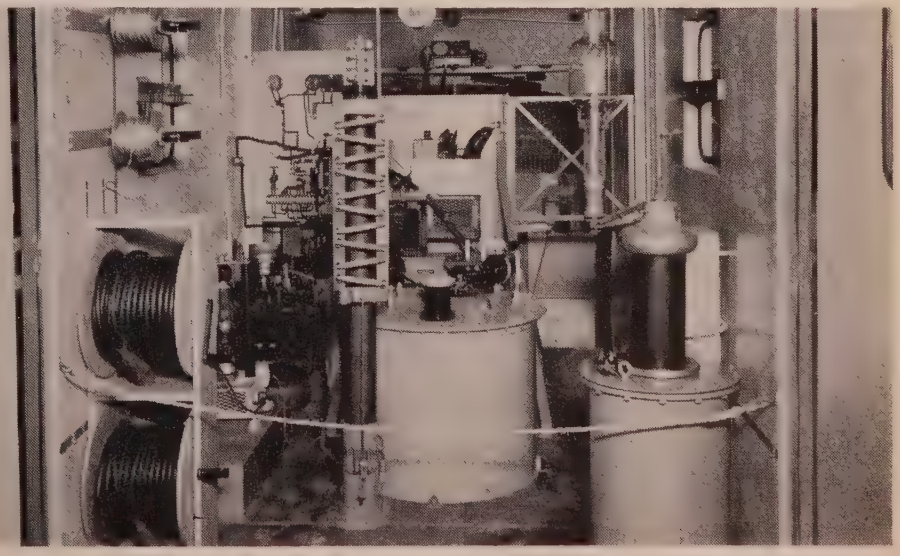


Fig. 6—With rear doors open, truck looks like this inside.

RESIDENTIAL UNDERGROUND GAINING ACCEPTANCE ON PGE SYSTEM

Development of the pad-mounted transformer has enabled Portland General Electric to provide underground service economically acceptable for homes in almost any price class.

By ERIC P. VERHEIDEN,
Chief Field Engineer
and
DON R. SELDEN,
Assistant Engineer
Tualatin Valley Division
Portland General Electric Company

RECENT ADVANCES made by our Company in the design and construction of low-cost residential underground systems has led to general acceptance of this type of service by developers in our area.

For some years, we kept in the back of our minds the eventual goal of an underground distribution system for residential subdivisions. Starting six years ago, we made underground estimates on certain subdivisions that were especially suitable for underground service. Since our policy, to avoid discrimination, is to require the developer to pay the difference between underground and overhead service, costs were the critical point.

Our early estimates, using lead cable in duct and a concrete tile with a metal lid for a transformer vault, averaged about $250 per lot difference. This did not include the service wires from the back property line to the house. The cost of this service added about $150 to the developers' cost, making a total of about $400 per lot. No developers in our area felt they could add $400 to the cost of a lot in the $2000 price range and still stay in business.

This situation continued for several years until the spring of 1959. The development of the pad-mounted transformer was the key that opened the door to low-cost residential underground service. With this new tool to work with, we decided in rapid-fire order to:

1. Use pad-mounted transformers placed on pre-cast transformer pads.
2. Use direct-burial cable for both high- and low-voltage circuits.
3. Furnish the house service conductors to a point five feet out from the house.
4. Do all trenching and backfilling except for that involved with the house service conductors on the lot involved.

Basic Material Specs Adopted

With the foregoing basic rules to go by we arrived at the following basic material specifications on the basis of design loading, ease of repair, expected durability, cost and availability:

1. Our standard primary cable, rated 15 kv, consists of a single No. 2 (7 x .0974″) copper conductor with a semi-conducting tape, 0.219″ high molecular weight polyethylene insulation, another layer of tape, a 0.005″ tinned copper tape, a layer of tape and a final layer of 5/64″ black polyethylene. The neutral is wrapped concentrically around the outside of the cable and consists of 16 No. 14 solid-copper conductors. This cable costs in the vicinity of 90 cents per foot. Our policy is to hold initial loads to not over 75 amps on this cable.

While we were investigating the special termination problems presented by polyethylene, we installed a similar type cable, but with butyl and neoprene insulation which costs considerably more.

2. Our standard low-voltage circuits consists of:

Table 1
Ultimate Residential Demands Used To Determine Cable Loading

	Unit Demand (kw)	Diversified Demand per Unit 6 to 12 Units (kw)
Permanent residence trailer courts	8	6
Multi-Family Dwellings less than 800 square feet	8	6
Multi-Family Dwellings less than 800 square feet, with heat	12	10
Multi- Family Dwellings more than 800 square feet	10	8
Multi-Family Dwellings more than 800 square feet, with heat	15	12
Single-Family Dwellings, no heat	12	10
Single-Family Dwellings, with heat	20	12

(a) Two separate No. 2 Cu. U. S. E. with a No. 4 Cu. bare neutral. We use this as the standard service to all homes. Maximum design load we allow is 75% of its direct burial rating, or 29.3 kw.

(b) Two separate No. 2/0 Cu. U. S. E. with a No. 2 Cu. bare neutral. This is used for secondary loads up to 42 kw (75% rating) and for services where the voltage drop on No. 2 U. S. E., from the transformer to the house, would exceed our design limit of 3%.

(c) Two separate No. 250-mcm Cu. U. S. E. with a 1/0 Cu. bare neutral. Normally used for secondary feeds up to 59 kw (75% rating).

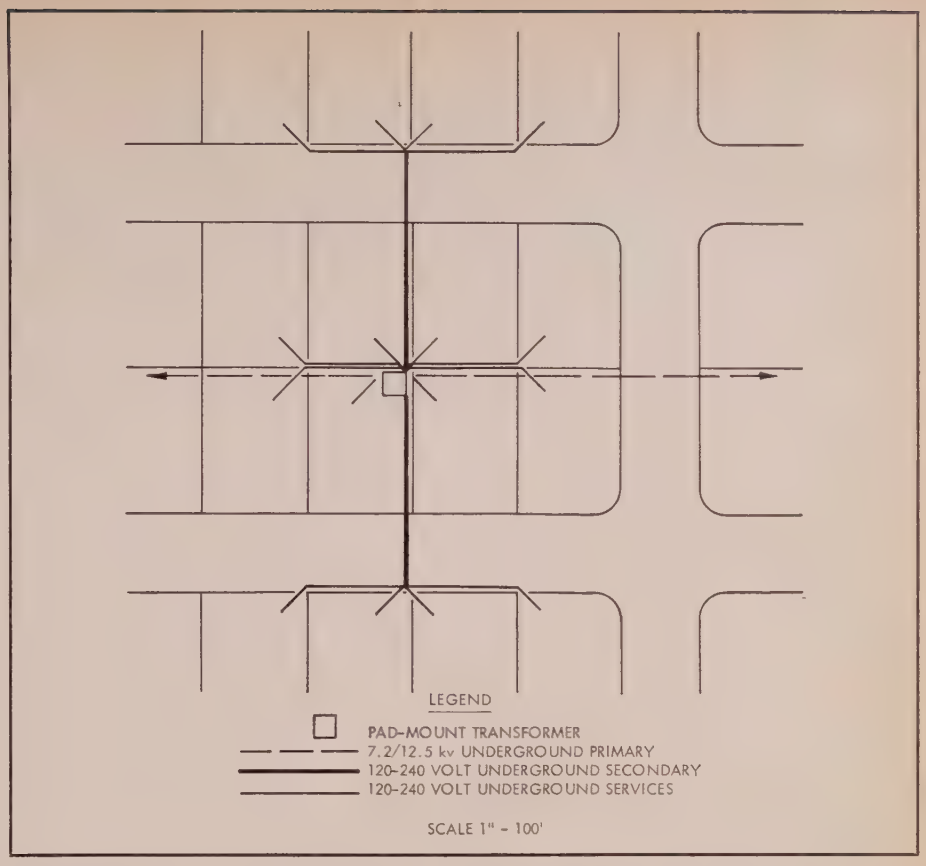
(d) A No. 10 Cu. duplex with polyvinylchloride insulation. We use this for serving street lights from our underground system. It is tapped to a secondary run or run directly from the transformer to the light. This wire is run through the street-light standard directly to the luminaire, thus eliminating any splices at the base.

We use the ultimate design demands specified in Table I, which are calculated to keep the cable loading within its capacity for its rated life.

We originally set our goal at a loop primary feed to all transformers to insure prompt restoration of service in the event of primary-cable damage. This also allows changeout of individual transformers without interrupting others. We also planned to have a separate service from the transformer to each house to insure utmost reliability and flexibility in case of damage to a service.

After making cost studies of quite a few subdivisions it was discovered that difference in costs varied from about $130 to as high as $225 per lot. This difference was mainly caused by subdivision variations such as the size and number of lots, general layout and terrain.

At this same time, we discovered that developers are willing to pay a maximum of about $175 per lot. If we wanted to promote underground, it became evident that loop feeds and separate services would have to be omitted on certain jobs.



Arrangement to serve 16 customers from one pad-mount transformer installation. Where it is possible to use this system, the cost per loss will be considerably lower than average.

Cornell Park (illustrated) is an example of a perfect layout for underground service. When completed, each transformer will have a dual feed and each house a separate service at a cost to the developer of $150 per lot.

Another subdivision had some rugged terrain. We still installed dual feeds to each transformer but we made use of secondary to hold costs to the developer down to $160 per lot. Still another subdivision was an example of what can be done to hold costs down in the face of a very difficult layout for low cost underground. In this, we used no dual feed and very liberal use was made of secondary. Cost difference to the developer is estimated at $164 per lot.

In the process of designing and pricing underground jobs, it has become apparent that the number of transformers and associated wire is the largest variable in the cost. We try to serve at least eight houses per transformer. In a perfectly designed subdivision, it is possible to serve up to 16 houses.

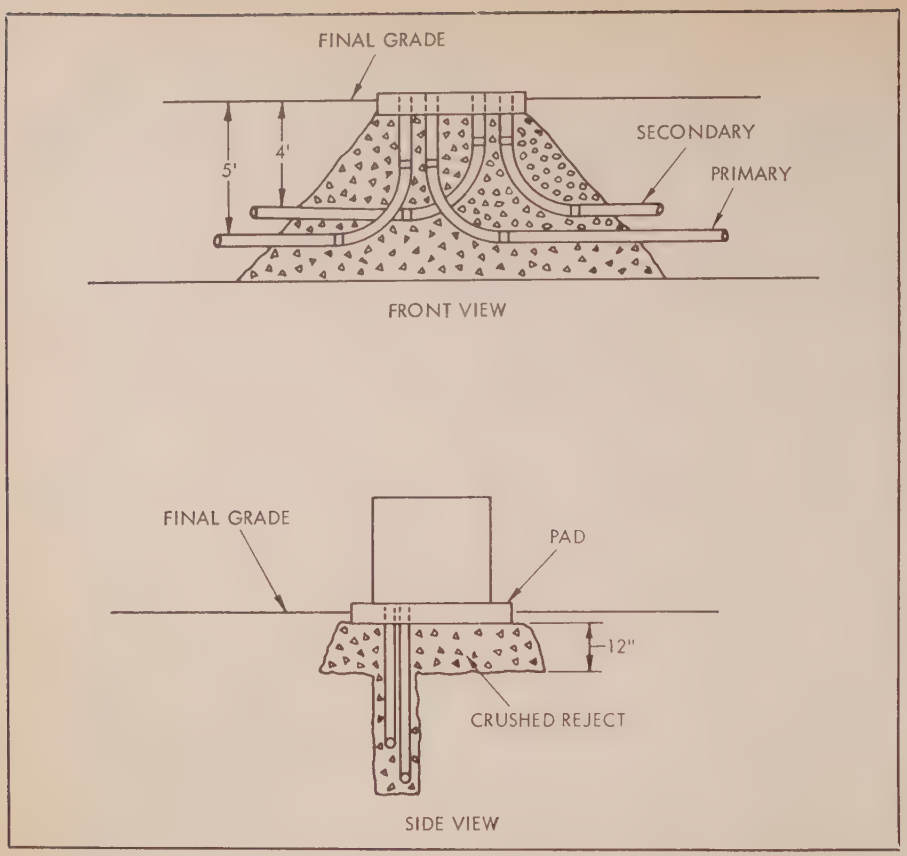
No Lack Of Problems

Lest we give the impression that all is utopia in our underground subdivisions, several problems should be noted.

1. Pad mounted transformers are not things of beauty to the average customer. He wants to hide them, and for this reason, it would be better if they were all painted green. In fact, our largest proposed development to date (450 lots) will have only green transformers, according to the developer. Also, it would help if pad mounts could be made smaller. Some developers shy away from the size.

2. Although we do not feel our underground systems are dangerous to the public, we do not want them dug up. Among other things, we try to get the developers to explain the cable locations to purchasers. Developers generally are familiar with the locations since we have worked with them on the utility restrictions or easements involved. We prefer recorded restrictions to the subdivision plat to give us our legal rights but we will accept easements if necessary.

3. For some strange reason known only to developers we are



To assure proper transformer stability through all soil and weather conditions, the area under the transformer pad is excavated and backfilled with reject crushed rock as shown in these sketches.

asked to put in most of the underground systems during the fall, winter and spring. Great care must be taken to hold costs down under such conditions.

4. Coordination problems with sewer, water, telephone, and gas services are difficult. Whether our system is installed first or last, the problems remain. In the first case, we have to keep track of all other utilities during their construction to see that they don't dig us up. The second case is similar, but in reverse.

With these many considerations in mind, we have proceeded with the actual installation of the underground system.

In the present stage of development, our division has experienced the completion of 12 projects with two more underway at the time of this writing. Without going into the details of each particular underground system installed, this represents service to 597 customers. In addition to this, there are 15 projects in the planning stage which would include service to as many as 2068 additional customers.

Contract Major Portion Of Job

Considering the many factors involved, we have found it practical to contract a major portion of the underground installation. We have furnished all primary cable and secondary junction boxes, which the contractor installs. In addition, he provides and installs all secondary and service wire, conduit, and transformer pads and footings. Our crews then set the transformers, make all primary and secondary terminations and splices, and connect each customer's service as it becomes necessary.

An important factor in the economic installation of underground service is trenching. Although all trenching was the responsibility of the developer in one of our projects, we have found, for reasons of coordination, that it can best be taken care of by the electrical contractor installing the cable.

Our specifications call for a trench whose minimum width is eight inches. This width is the narrowest which would still allow a four-inch cushion of sand to surround the cable. In soil conditions which will permit, a narrower trench may be chosen at the discretion of the company engineer, who is on hand to inspect all phases of installation.

We have found that trenches as wide as 36 inches are necessary in some locations under varying winter weather conditions which require constant maintenance of the trench during cable installation. This is the exception to the rule, however, as our average trench width has been 14 inches.

In all projects since our first, we have installed our direct-burial primary at a depth of five feet. The additional foot in depth, which was gained at little additional expense, has given us an additional margin of safety from interference with other utilities or the home owners landscaping plans and subsequently has added to the anticipated reliability of the system. We have felt so strongly on this issue that we have maintained our five-foot primary depth even though the trench had to be blasted through rock in portions of one project.

Where the trench has been blasted and extremely jagged conditions are found, we have pulled the cable in polyethylene pipe. Elsewhere as conditions justify, the installation includes a four-inch cushion of mason's sand above and below the cable. We have specified selected backfill material in a manner which leaves it to the discretion of the company engineer where precautions other than a fine dirt

backfill are required. In all cases, a minimum of 12 inches backfill is required before placement of either secondary or service conductors.

From our previous experiences we have found it best to locate the trench four feet away from the property line in back-lot construction and one foot out from the property line when paralleling the street in the road area. The latter position places our conductors just under the edge of the sidewalk and involves less conflict with other utilities, in this area. Where the primary cable crosses the paved portion of the street, we have been led by experience to install either galvanized or black steel conduit, as necessity dictates.

Handling the primary cable during its installation requires the greatest amount of care that is necessary for any phase of the installation. Two primary hazards must be avoided. First, there must be extreme care never to exceed the minimum bending radius prescribed for a metallically-shielded cable, whether in handling or in its final position, to guard against ultimate electrical breakdown of the cable insulation. Second, there must be no contact with sharp projections which might damage the outer jacket of the conductor, permitting moisture to further damage the cable insulation.

Underlay Pad With Crushed Rock

Even though cross trenching is held to a minimum in the transformer pad area, there is usually too much disturbed earth to allow a dirt backfill in this area without serious settling problems. We have found that in order to maintain a level transformer through all weather conditions, the entire area under the pad must be excavated to a depth of one foot, or below the cultivation level. This area including the trench is filled with reject crushed rock which has enough dirt and sand in it to have excellent compaction qualities. To protect the cable from the crushed rock and to allow possible future cable replacement, 3-in. primary duct and 4-in. secondary duct is extended out past the crushed-rock footing.

The contractor has found it more practical to purchase precast pads from a local cement-products manufacturer than to pour the pads on the site. These pads are steel-reinforced to our specifications and measure 57″ x 52″ with a minimum thickness of four inches. When setting the pads in an interior easement of five feet, we allow a 3-inch spacing at the back to avoid conflicts with future lot fencing, which places the front edge of the pad on the edge of the easement. We have a minimum clearance of one foot between the pad and any side lot lines, allowing ample door swing for various transformer models which might be used.

Secondaries are terminated either at direct-burial splices, or are extended into secondary junction boxes which are equipped with terminals to handle the 250-mcm secondary and six services. All individual services are provided for

Barely visible behind shrubbery in center of picture is a pad-mounted transformer located at rear lot corner. From this position nine customers and two street lights are served. In other projects underground service is supplied to homes priced from $13,900 to $45,000.

This method of installing primary has worked very satisfactorily, when possible. Cable is taken from reel as truck is driven along trench. Fine powdered dirt for backfill allowed trench width of six inches. Trench depth is five feet.

Regardless of how dirt backfill is tamped, heavy winter rains will both wash and settle the earth. Pad footings are now built up with reject crushed rock which allows very little settling.

at this time by coiling, moisture-proofing the ends, and burying in the lot corner with a board on top, enough wire to reach the customer's point of entrance.

After setting the transformers, primary terminations can be made up. Connections inside the transformer involve use of the standard indoor-type stress cone. Cable pole terminations are made in compound-filled pot-heads and are always protected by a lightning arrester.

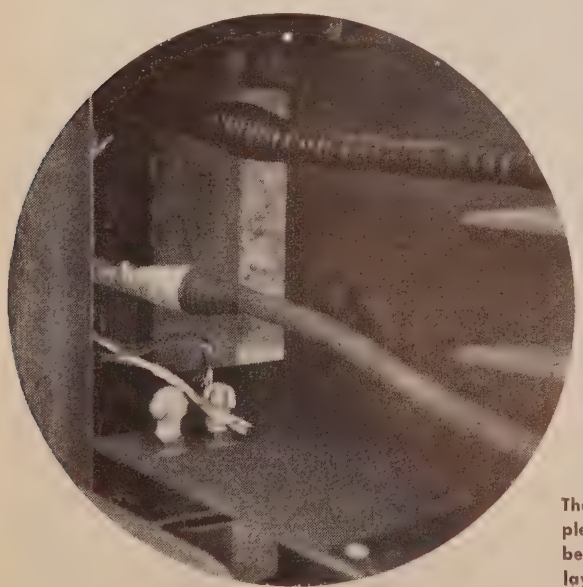
This usually concludes the initial installation of the underground system. As the homes are being built each builder will provide a trench of our specifications from the house to the designated corner of his lot where the service wire is coiled and buried. At that time our service crew will run the service and splice it to the customer's entrance. In most cases it is desirable to get the underground system installed before any large-scale building program is underway which might require extensive temporary services.

Primary ducts are positioned using a two-piece template, the larger portion of which is removed when proper pad location with respect to property corner is determined. Remaining area under pad is then excavated to 12-in. depth.

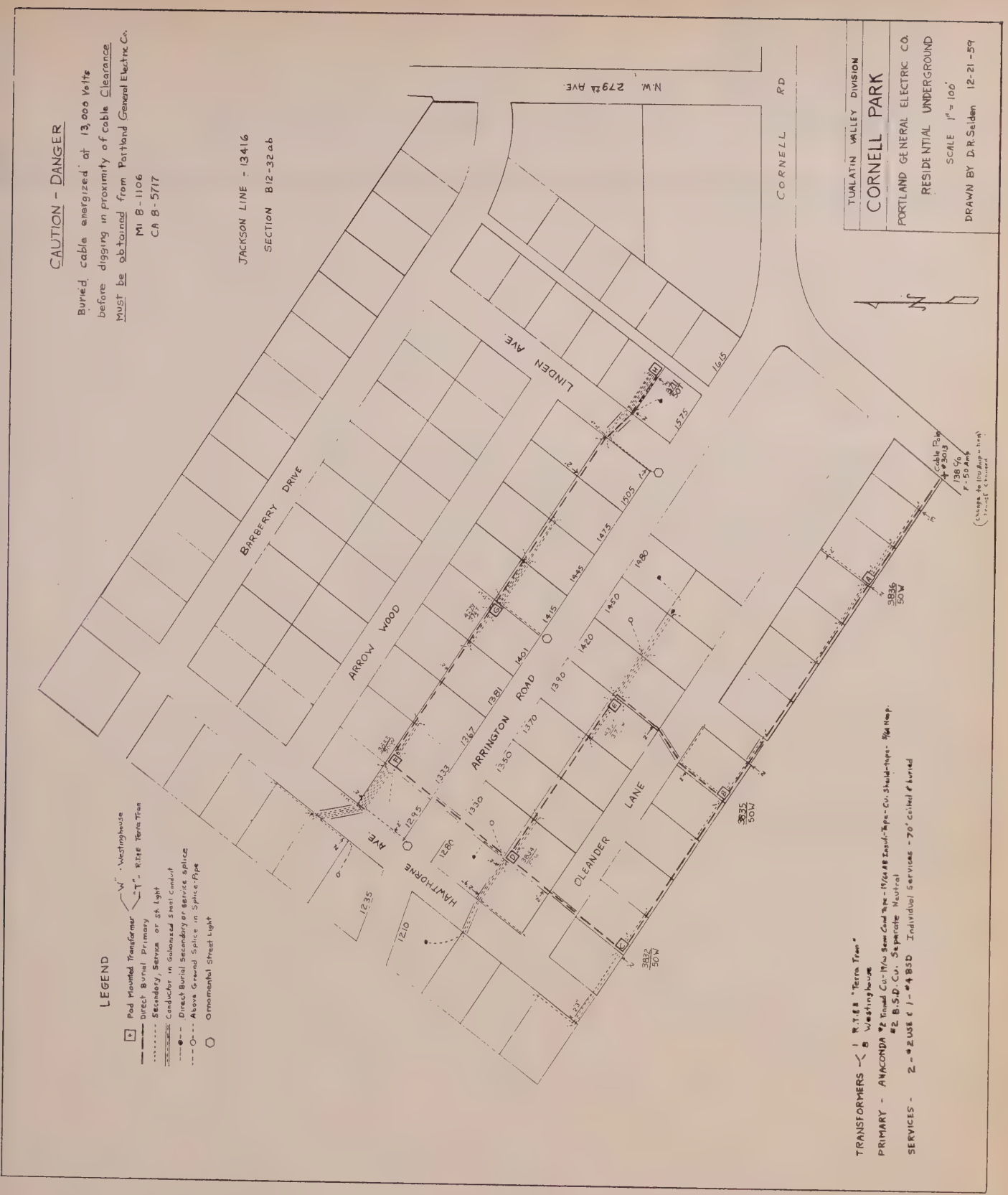
Accurate Maps Indispensable

Although mapping and inspection of the underground system is mentioned at this point, it should be understood this must be an almost continuous process. In addition to handling coordination problems which might arise, the trenching must all be inspected for location with respect to property lines and easements, as well as for conditions, to determine the necessity for sanding or other necessary precautions. A complete inspection of the primary cable must be made prior to any backfill to the secondary level. At this time also, all mapping dimensions regarding primary cable location must be obtained. After one foot of selected backfill material is applied by hand and secondary conductors are installed, additional mapping is required.

With our system of initially burying all service wire for each lot,



The left stress cone has been completed, while the one on the right has been built up and needs only final layers of tape to be applied.



The arrangement of lots in Cornell Park was such that individual services and primary-loop feed were both technically and economically feasible.

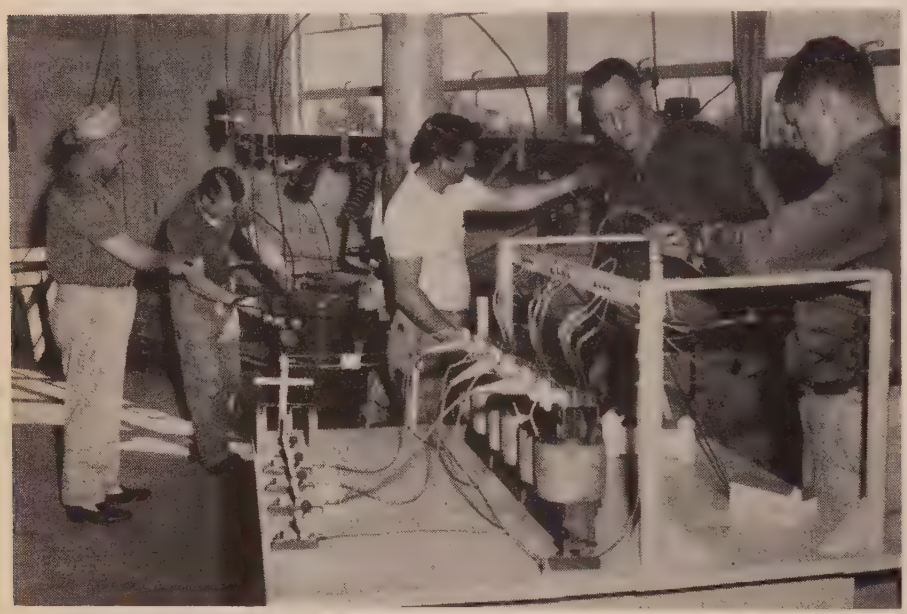
extremely accurate dimensions must be obtained to locate this wire as it becomes necessary. The availability of accurate maps of our system to developers, other utilities, or persons needing to dig within the area has doubtless resulted in greater safety and reduced maintenance of the system.

From all indications available thus far, a new trend in distribution has been started which brings its unique features within the region of practical acceptance in homes of almost any price class.

INSTRUCTION BOARD RECONSTRUCTS TRANSFORMER TROUBLES

By Daryl E. Gaiennie
Asst. Supt. of Transmission & Distribution
Savannah Electric & Power Co.

The transformer repairmen of Savannah Electric & Power Co. have constructed a transformer training board which not only instructs employees in transformer connections under ideal conditions, but also reconstructs any trouble with transformer banks in the field.



Instruction board reconstructs at the company's Operating Center, any trouble with the transformer banks which may be experienced in the field. This makes it possible to teach men the "hows, whys and whats" of transformer connections under ideal conditions—eliminating a lot of the misunderstanding so often encountered when the "old timers" teach the "young uns".

The "board" consists of a table with three 3-kva 2400/4160-v transformer cores and coils bolted to it. They are connected through glass cartridge fuses and knife switches to the building voltage of 120/208-v. The transformer primary and secondary leads are terminated on brass posts with flexible insulated conductors and spring-loaded clips. By using a 4-wire secondary "bus," it is possible to make any transformer connection.

Also provided is a pole with three transformers cluster-mounted adjacent to the board, so employees may see the physical connections as they would normally be made. With transformer manuals describing a specific connection, then connecting the cluster-mounted bank, the employee connects the "board" and closes the individual fused switches. If the connections are incorrect, the fuses react in the same way they would in actual practice, and "blow."

Because the men are familiar with voltages that are taken in the field, the scale of a voltmeter is changed so it reads in the 120/240-v range instead of actual secondary voltage on the board of 6/12-v.

ATTRACTIVE AND SAFE SWITCH HOUSES

Steel switch houses—19 of them—were recently built for a Missouri utility by Delta Star Electric Div., H. K. Porter Co., Inc. They were built for safety and scenic-conscious residential customers.

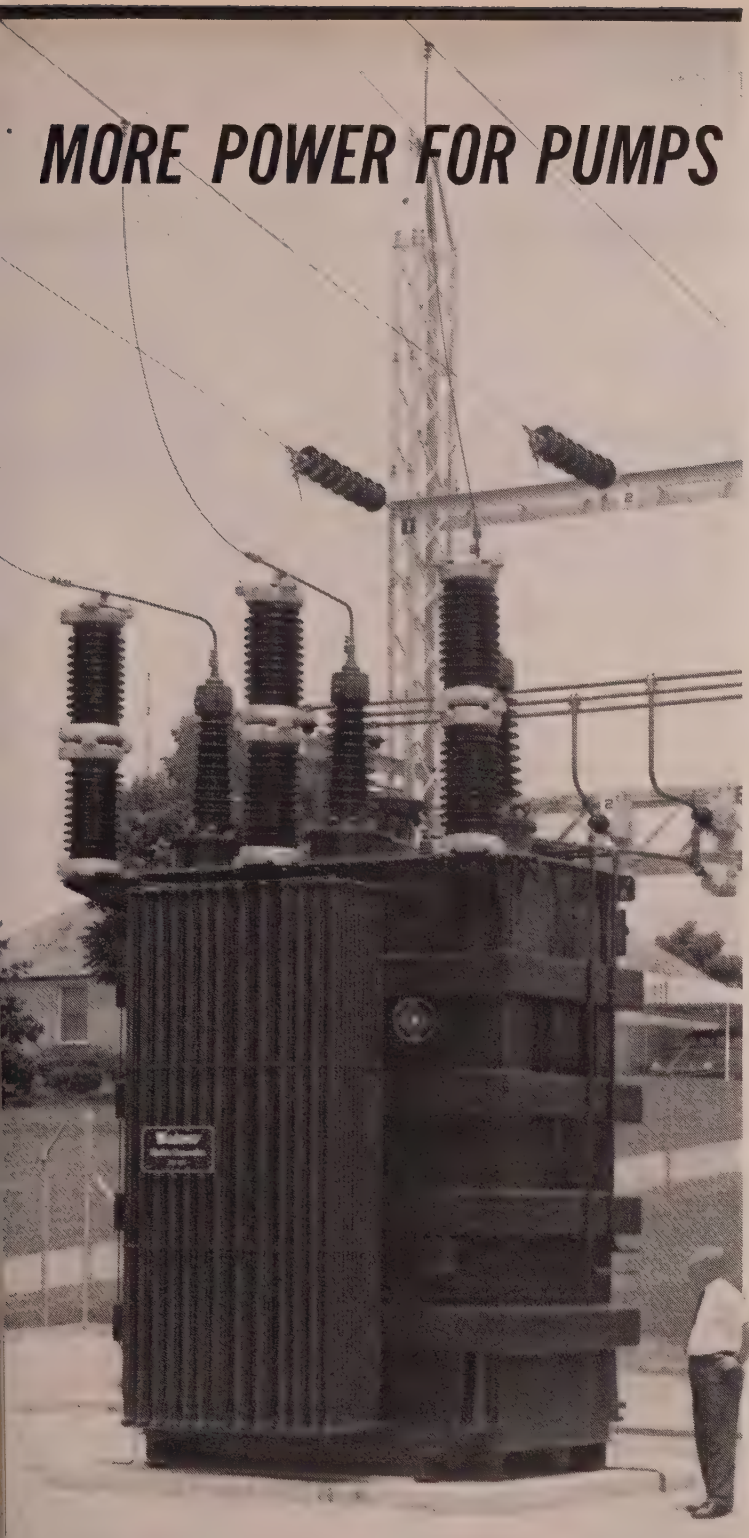
Each has a slanting roof designed for compactness, which also prevents accumulation of rain or snow. A three-phase disconnect switch with enclosed-type interrupters rated 600 amps at 34.5 kv, was installed. Provision was also made for potential transformer, lightning arrester, three incoming lines and 3 load-side bushings.

With switch installation, the house weighs some 4,000 lbs and measures 9 ft 7 in high, 6 ft 8 in deep and 8 ft 6 in wide. Transportable by truck, each house was equipped with lift brackets for lifting it into position on a concrete slab, and for attachment of take-off towers.

The switch is motor-operated by a mechanism attached to either the right or left side of the house. Locked mechanism, bolted doors, and sealed windows provide safety.

Compact switch house designed for a Missouri utility presents an attractive appearance in residential area. This unit is complete with switch, mechanism, and take-off tower.

MORE POWER FOR PUMPS THAT PUSH PETROLEUM



THIS WAGNER TRANSFORMER *POWERS-UP* PLANTATION PIPELINE

The Plantation Pipeline Company pumping station at Neese, Georgia, is part of an underground transportation system that pushes high quantities of petroleum products to their market.

The Neese operation was originally served with power from a 44 kv system substation. However, the size of the pumping load—which includes some 1800 hp motors—became too great for the substation to handle adequately.

To better serve the load, Georgia Power Company recently installed a 110 kv line and built a new substation. Wagner Electric Corporation furnished the transformer rated at 7500 Kva for this purpose. Today, Plantation Pipeline pumps with full power.

Now, what about your power needs? If they present a critical (or even a potential problem), call your nearby Wagner Sales Engineer. He'll help you plan your power program . . . suggest Wagner transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

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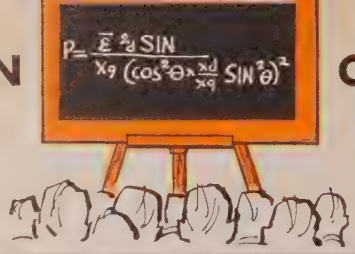


AIEE Lamme Medalist Sees Power Industry Increasing Ten Fold In Next 36 Years

Barring a "catastrophic war" there will be a ten-fold increase in electric power consumption in this country in the next 36 years, Lee A. Kilgore, director of engineering, Westinghouse Electric Co. predicted at the Summer General Meeting of the American Institute of Electrical Engineers in Atlantic City, N. J. June 20. His forecast was made as he received the 1959 Lamme Gold Medal.

The Medal was presented to Mr. Kilgore "for meritorious achievement in the design of electrical machines; more specifically, for analysis of synchronous machine reactances; for invention of special armature windings; and for inventions and designs related to large adjustable speed alternating current motors."

Election of Clarence H. Linder as president was announced. He is vice president and group leader, electric utility group, General Electric Co., N. Y.

Some 2000 engineers from this country and foreign lands attended the five-day meeting. Following are excerpts from technical papers significant to our industry.

Energy Conversion

"Our future efforts in the area of energy conversion research are clearly indicated," said S. W. Herwald, vice-president, research, Westinghouse Electric Corp., during a symposium on "Expanding the Future of Direct Energy Conversion." The problems—primarily those of a materials nature — demand comprehensive research.

The symposium considered problems in the areas of MHD, Thermionics, Thermoelectricity and Fuel Cells. "Perhaps two decades will elapse before we see these methods of conversion developed to the wide-scale use we envision. But it is clear that, as we look to the future, some means of alleviating the burden on our supply of fossil fuel is a necessity," he urged.

In Richard W. Porter's paper, "Adventures in Energy Conversion," the General Electric Co. author discussed efficiencies of the four energy conversion areas. In the fuel cell category, he gave some cost figures for the ion-exchange membrane hydrox cell.

"A quick survey of present and projected state of the art indicates that such a cell might have a basic cost as low as $210 per kwh. An alkaline hydrox cell, which would avoid the use of platinoid catalyst material could conceivably bring this cost down; we project a basic cost as low as $42 per kwh. On the other hand a molten carbonate cell which could burn less expensive fuel at very high efficiency might eventually have a cost on the order of $150 per kwh," he said.

Consensus of the group: "There is a long way yet to go."

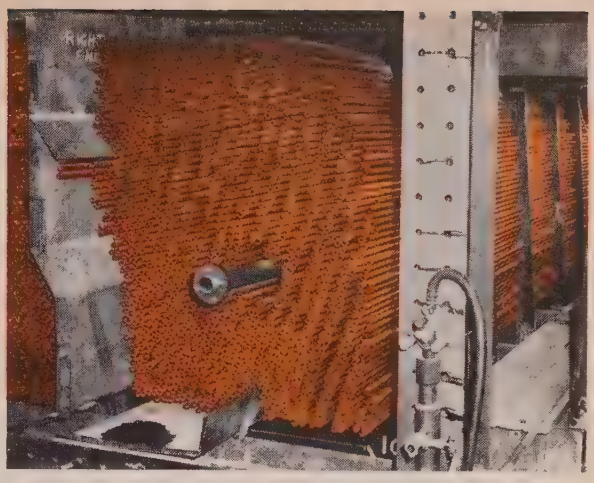
ADP In Puerto Rico

Main economic gains expected to result from the use of an automatic data processing system in Palo Seco Steam Plant of Puerto Rico Water Resources Authority were outlined in a paper by R. R. Ramirez and M. Iriarte, Jr., both of Puerto Rico Water Resources Authority and R. R. Tressler, Jackson & Moreland, Inc. The paper was presented by Mr. Tressler. The gains include: (1) Higher plant operating efficiencies; (2) Manpower reductions; and (3) Increased plant availability.

Based on an installed cost of $170,000, fixed charges of 11 percent, and an estimated annual maintenance and operating cost of $12,000, comparison of estimated savings versus cost for the ADP system shows total evaluated sav-

Lee A. Kilgore (second from left), director of engineering, Westinghouse Electric Corp., receives the Lamme Gold Medal from outgoing AIEE President J. H. Foote, chief engineer, Commonwealth Services, Inc. Looking on from left to right are J. H. Chiles, Jr., vice-president, Westinghouse Electric Corp., and chairman of the Lamme Medal Committee, and J. F. Calvert, University of Pittsburgh, who presented the Career of the Medalist.

New Dickerson Station of Pepco equipped with over 170 miles of Phelps Dodge Condenser Tubes!



The newest power station of the Potomac Electric Power Company at Dickerson, Md., fills a big need for increased electric power in the greater Washington, D.C., area. The plant's two mammoth generating units, each with a capacity of 175,000 kilowatts, boost PEPCO's total electrical capacity by nearly one-third.

Within the giant condensers of the units are more than 170 miles of Phelps Dodge Admiralty and Cupro-Nickel condenser tubes weighing over a half-million pounds. These tubes were specified because of their record of proven dependability and long service life in similar operating conditions.

In every industry that uses heat transfer equipment, Phelps Dodge tubes are known for their lasting quality. This reputation has made Phelps Dodge a leading fabricator of copper and copper-alloy tubes for the manufacturers of condensers and heat exchangers.

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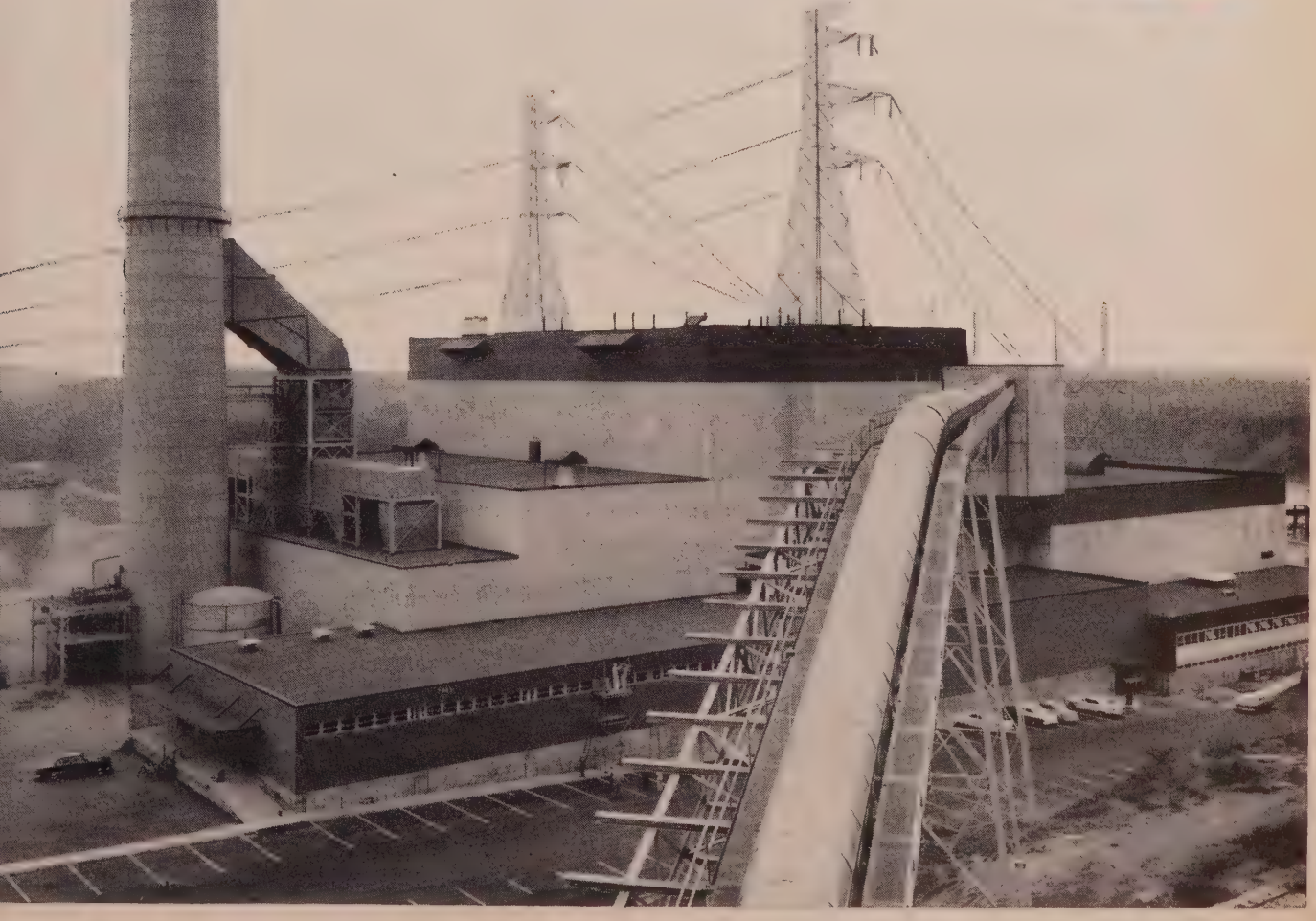
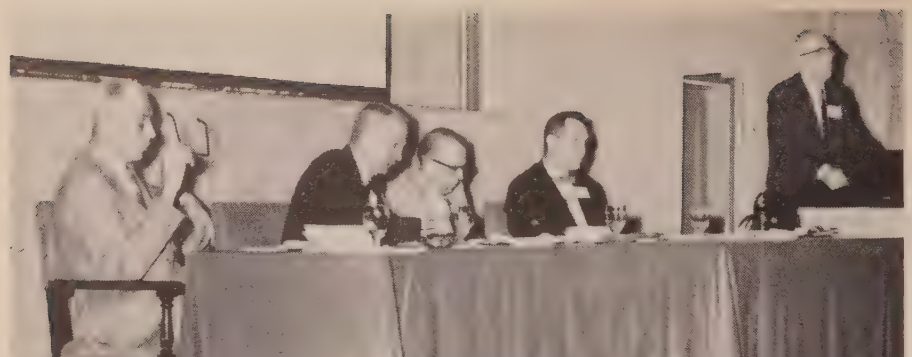




Round table discussion on data handling and computer control of power plants was run by (l-r) C. M. Quick, Public Service Electric & Gas; E. G. Norell, Sargent & Lundy Engineers; G. Barney, Stone & Webster Engineering Corp.; R. R. Tressler, Jackson & Moreland, Inc.; and E. E. Brown, Philadelphia Electric.

ings of $23,000 as compared to a total annual cost of $30,700.

Data Logging—A Start

"It appears that data logging and computer equipment can be applied with the greatest benefit and justification in completely automated generating stations," said G. Barney, Stone & Webster Engineering Corp. "However, this is a large step which most people are not willing to take at the present. Instead, several utilities have chosen to start with simple data logging, alarm monitoring and possibly performance computations. These initial steps offer gains in the way of improved and more reliable performance from more closely supervised equipment and in some cases do so with fewer operators," he said.

At the same time experience is being gained in preparation for succeeding steps which might be partial control and finally complete automation of the station.

Short-Time Shutdown Studies

While a general rule which has been used for the removal of capacity from service was of the general form—"Remove the unit with the highest heat rate, providing that four hours will elapse before restarting the unit, otherwise, operate the unit on the incremental load schedule"—This rule now has so many exceptions that more than a general rule is required to obtain the most advantageous operating practices, said A. P. Hayward and R. M. Buchanan, both of Duquesne Light.

The authors presented curves which show heat input-power output relation of several typical turbine generator units. There is a general relation that has a direct bearing on the selection of operating capacity. The larger units may have higher "no load" heat inputs than the smaller units. Also, the larger units have lower incremental heat input. These relations may make it more economical to operate an older unit for spinning reserve for a short duration during a weekend, than to hold a larger unit in service, or to start such a unit.

The authors presented another set of curves which give the occurrence in days of minimum and maximum hourly output for the day. One shows the maximum hourly output for each day. The other gives the minimum hourly output for each day. These curves provide a basis for a shutdown and start up count for a monthly or annual cost analysis. They are used in the same manner as a load duration curve and are derived from punched cards that record the hourly outputs of power stations and interconnects, which are then used to tabulate daily records by hours and to prepare monthly and annual load duration data. The daily maximum and minimum outputs are coded when the cards are punched. The coded cards are then sorted on system outputs and added in groups of ten and tabulated to form the data for the maximum-minimum load duration curves.

Shutdowns In Light-Load Periods

The realization of operating economics by the shutdown of high-pressure, high-temperature generating units has been facilitated by the development of quick start techniques. Start-ups of Consolidated Edison units are made in a matter of 15 to 20 minutes following an overnight shutdown, stated H. C. Orten, M. Salvage and M. J. Steinberg, all of Con Ed. Exhaustive quick start-up tests in the industry indicate that with proper precautions and equipment, units can be shutdown and restarted daily without exposing them beyond the margins of safety incorporated in their design.

New Techniques Needed

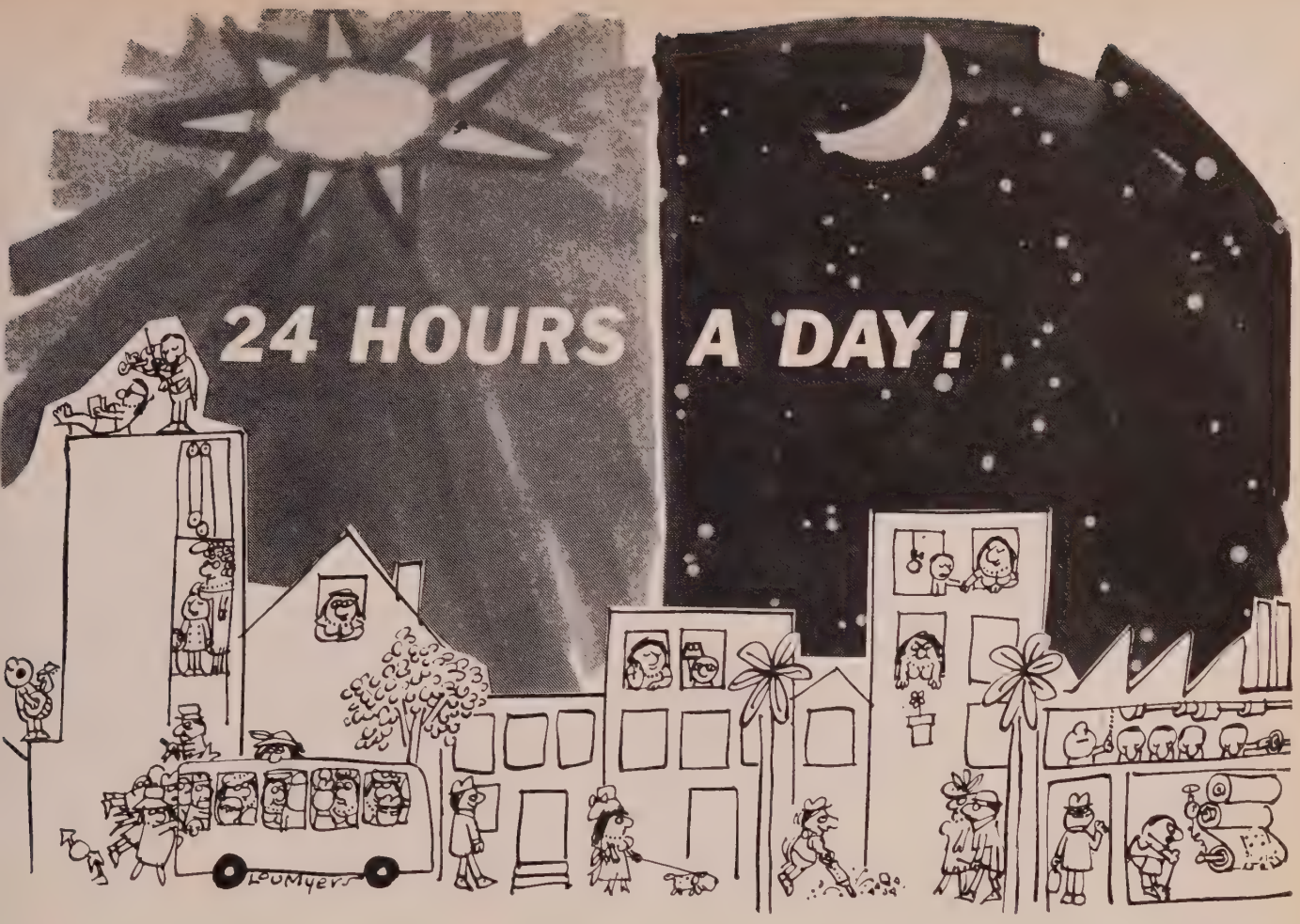
While skyrocketing fuel and labor costs have been offset, in part, through the installation of larger and higher pressure turbine-generator units, and through the use of central control rooms and automatic control equipment, further reduction in production costs can be realized only through new techniques which will permit improvements in fuel economies through better control, manpower reduction and safer operation, according to a paper by R. A. Baker which was presented by C. M. Quick of Public Service Electric & Gas Company, New Jersey.

In considering the control of a new 342-mw unit for Sewaren Generating Station, scheduled for 1962 operation, studies have shown that substantial savings can be realized from a higher degree of automation through the use of a general purpose digital computor. The plus factors in the evaluation are manpower savings, safety to equipment, fuel savings, automatic performance testing, reduction of outage time, and replacement of conventional data logging equipment.

Soil Conditions and Underground

A report of the AIEE Insulated Conductors Committee on soil thermal characteristics in relation to underground power cables is contained in Transactions Paper 60-785. It is a presentation of five papers which may be considered as a reference manual. Important factors which have a bearing on the overall problem: What is the soil thermal resistivity along a cable route or how can the maximum efficiency of the soil thermally be obtained?

Included are a statement of the problem and objective; soil types—



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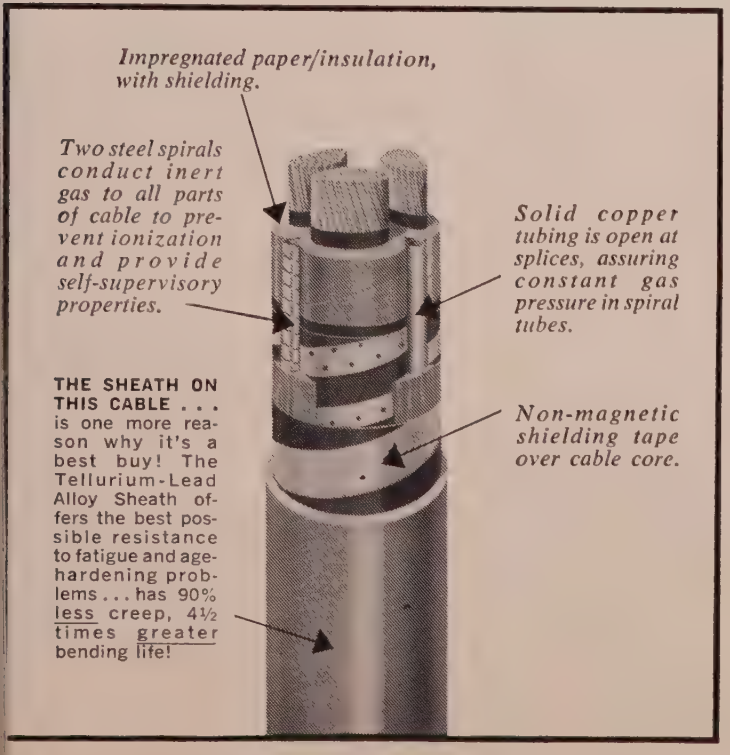

Roebling Gas-Filled Cable (for voltages up to 46 kv) is *self-supervisory!* Super-dry nitrogen gas, inside this cable at approximately 12 p.s.i. pressure, is the key. When gas pressure drops below 10 p.s.i. or rises above 16 p.s.i.—an automatic signal message is relayed to the nearest attended station. You know when trouble's afoot the second it starts! Repairs can be made *before* serious damage occurs!

Along with this extra *protection*, this cable has properties that lessen the possibility of outages! The inert dry nitrogen gas provides consistent dielectric properties throughout the length of the cable. It prevents ionization, too, and the other problems often associated with solid-type oil-impregnated cable. What's more, it's as easy to splice as solid-type! And if your system includes grades, it may prove to be the most inexpensive cable you've ever used!

Our new Gas-Filled Cable book tells more about this superbly-made cable. It's free—write for it. Roebling's Electrical Wire Division, Trenton 2, New Jersey.

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identification and physical properties; soil moisture characteristics; soil thermal resistivity—typical field values and calculating formulas; practical application—trench design and construction; and measurement techniques.

Bus Switching Surges

Bus switching surges which caused 97-kv arrester failure on a 115/2.4-kv reserve auxiliary transformer while the 115-kv transfer bus was being de-energized with an air-break switch were analyzed by L. C. Elliott and H. M. Smith, both of Westinghouse, and L. C. Weber, Northern States Power.

"One very effective method of controlling overvoltage under conditions studied in this paper is by the use of a series-gap resistor installed on the disconnecting switch," they said.

Transmission Influences Distribution Cost

The influence of transmission on distribution system cost was discussed by D. N. Reps and J. E. McNabb, both of Westinghouse Electric Corp. Their analysis extended the study made in Transactions paper 60-177 and 60-178 to include the cost of transmission.

The authors conclude that step-down directly from 230 kv to *any* primary-feeder voltage (i.e. 13, 23, or 34 kv) is costlier than the employment of an intermediate, subtransmission voltage of 69 or 138 kv. "Moreover, the combination of subtransmission and primary-feeder voltage yielding lowest cost over the widest range of residential-area load densities is 69/13 kv."

Economic Primary and Substations

In two companion papers, J. A. Smith, General Electric Co., discussed the economics of primary distribution voltages of 4.16 through 34.5 kv and their relationship to the determination of economical distribution substation size.

In his conclusions, he included the following: "Of systems commonly used today, direct transformation from 69 or 138 kv to 12.5-kv distribution is less expensive at all load densities studied, than a double transformation from 69 or 138 kv to 34.5 kv and then to 4.16 or 12.5-kv distribution except for 138-34.5-12.5 kv at 1000 kv/sq mile. A single transformation from 69 to 4.16 kv is also more expensive than 69 to 12 kv at all load densities.

"If a change to higher distribution level is being considered, 12.5, 13, or 20.8 kv appear to be the logical choice unless the existing system makes it easier to grow into 23 or 24.9 kv instead.

"Direct transformation to 34.5-kv primary distribution appears to be considerably more expensive than 12.5, 20.8 or 23 kv unless heavy feeder loading is acceptable at load densities of about 10,000 kva/sq mile and higher," he noted.

On substations he said, "For 4-kv distribution, the cost of express feeders and associated I^2R losses tend to economically favor small substations in the range of four to six feeders until a load density of greater than 4000 kva/sq mile is reached.

For 12.5 kv and higher-voltage distribution, economical substation sizes tend to range from 24 up to 96 mva or larger. As compared to 4 kv, the economical substation size increases more than the three to one increase in voltage."

Radio Noise Attenuation Constants

Ground losses appear to be the major source of attenuation for most modes of propagation on power transmission lines, concluded L. O. Barthold and G. E. Adams, both of General Electric Co. in their paper on the calculation of attenuation constants for radio noise analysis of overhead lines. They also concluded from calculation and field tests that for modes in which the ground losses predominate, an increase in conductor size appears to increase attenuation. "Ground wires reduce the attenuation for the line-to-ground mode," they said.

Optimum Regulating Point

"Within the range of per-customer loads extending from two kva to eight kva peak diversified demand, allowable investment for the voltage-regulating component of each distribution transformer lies approximately between $150 and $800 in 4-kv systems, and between $50 and $500 in 13-kv systems," said R. F. Lawrence, D. N. Reps, and A. D. Patton, all of Westinghouse Electric Corp.

Aeolian Vibration Fatigue

Rational means are now available to predict the fatigue life of suspended transmission line cables subjected to aeolian vibration, according to Robert F. Steidel, Jr., University of California.

Incipient-Fault Detector

An effective and sensitive means for detecting low-energy incipient faults in power transformers having gas space above the insulating oil was presented in a paper by P. S. Pugh, American Electric Power Service Corp., and H. H. Wagner, Pennsylvania Transformer Div. McGraw-Edison Company.

A valuable feature of this method described by the authors is that gas samples are taken without de-energizing or disturbing the operation of the transformer in any way. When an incipient fault is indicated, an evaluation of its seriousness can be made and an outage predicted and planned.

60-Cycle Flashover

60-cycle wet flashover of suspension insulators may occur in actual operating practice at voltages as low as 50 per cent of the published values, according to a paper by R. J. Mather and M. G. Poland both of U. S. Department of Interior, Bonneville Power Administration. "This may occur with a heavy, low resistivity rainfall on clean insulators or a lighter rainfall over iced insulators. This influence should be considered in studies of reduced insulation levels," they said. Their conclusions were based on rainwater samples, made by operators at twenty-six of the larger substations of the BPA system, which for the most part, are manned 16- to 24-hours per day.

Breaker-and-a-Half Bus Design Benefits

Benefits of the breaker-and-a-half bus design on 161-kv substations were discussed in a paper by H. C. Sampers, Omaha Public Power District.

"The number of possible operating arrangements and the proven high degree of operating dependability makes the breaker-and-a-half bus design particularly suited for large switching, interconnecting and unattended, remotely operated substations," he said.

Peaking And Continuity Requirements Met By Unattended Diesel Station

Participating in start-up ceremonies were: (l-r) Harold Mann, EMD district manager; (behind him) Duane Arnold, vice-president and general manager, IEL&P; Charles Whitmore, president, Iowa-Illinois G&E; N. Bernard Gussett, chairman of the board, Iowa P&L (shaking hands with Senator Bourke Hickenlooper); (between Messrs. Gussett and Hickenlooper), Herbert Henderson, vice-president, engineering, IEL&P; Dr. James Hilton, president, Iowa State University; Harold Rowe, director of public information, IEL&P; Richard Terrell, vice-president, GM; and Sutherland Dows, president IEL&P, who MC'd the ceremony.

A new model dual-fuel diesel peaking and reserve power plant was dedicated and demonstrated July 8 by Iowa Electric Light & Power at Ames, Iowa. The Electro-Motive Div. of General Motors' 2000-kw power plant will provide peaking power in the Ames area, and emergency protection for the new $17-million Department of Agriculture Animal Disease Research Laboratory near Ames.

The plant is a remote-controlled, automatic unit capable of operation on natural gas or diesel fuel. It is equipped with dead load pick up which automatically brings the entire plant on line within seconds after disruption of normal service. When put into service by Iowa IEL&P, it will be operated from the power station at Boone, Iowa, 20 miles away. No personnel are required at the site to operate the equipment.

Here's how the sequencing operates in emergency dead line operation:

If an outage occurs on Iowa EL&P's 34.5-kv south line, and the first attempt at reclosure fails, an automatic signal from the IEL&P system activates a 30-second waiting cycle in the peaking plant. After the half-minute, the engines start automatically and come to full speed immediately.

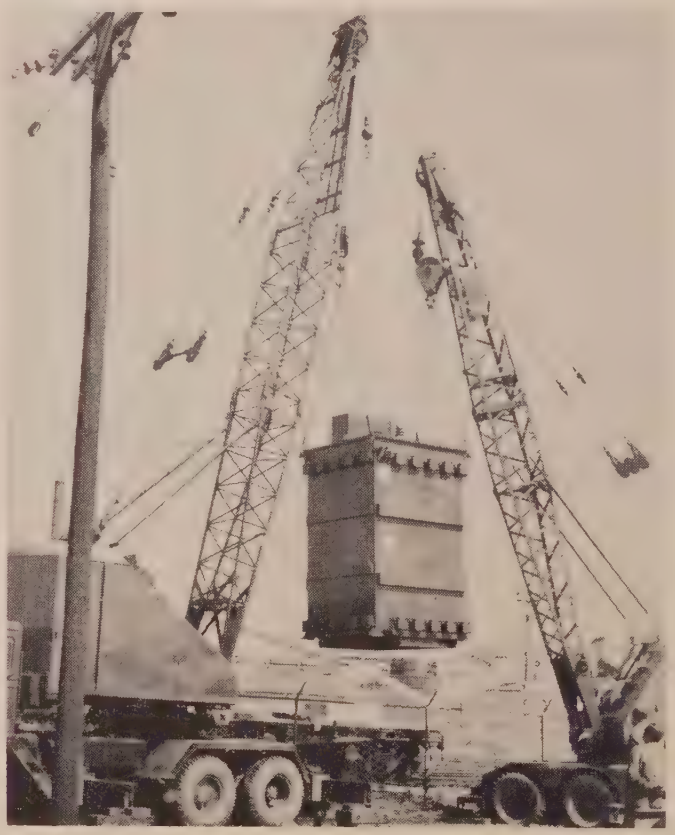
If attempts by IEL&P to tie into their 34.5-kv north line fail, and both high lines are out, a second automatic signal from the power company system closes the power plant's breakers and the unit takes the full load. Following the first indication of an outage, if either IEL&P high-line holds, the peaking plant still continues to run at full speed for three minutes before shutting itself down automatically.

When IEL&P's high lines are restored following an outage, the peaking plant automatically re-synchronizes under load with the power company system. The peaking plant then converts itself back to a peaking operation and runs until shut off by a remote signal from Boone. No manual signal is needed during the dead load sequence. However, a leased-line pulsed signal from Boone is used to put the diesel plant into normal peaking service.

The Ames plant has other important capabilities. Its normal fuel mixture combination is six percent diesel (used for ignition) and 94 percent natural gas. Being a dual-fuel unit, it can automatically switch to straight diesel fuel operation in case of low, or loss, of natural gas pressure. Following return to normal gas pressure, the unit returns to dual-fuel operation.

In case either or both of the separate 34.5-kv feeders (left) fail, the EMD Model MU28DF stands ready to pour 2000 kw into the National Animal Disease Laboratory lines within 90 seconds. In addition, it is to be used six days a week for system peaking power.

Four New Transformers Increase Hubbard-Kearney Lab Capacity



Two cranes hoist momentary current transformer over the fence at the Hubbard-Kearney Electrical Laboratory in McCook, Ill. Unit will produce up to 300,000 amps for testing thermal and mechanical effects of extremely high short circuit currents.

To enable them to continue development of new and advanced electrical equipment, Hubbard and Co. and James R. Kearney Corp., manufacturers of electrical apparatus and pole line hardware, have added four new transformers to the Hubbard-Kearney Electrical Research Laboratory at McCook, Ill.

The largest of the transformers will provide momentary currents up to 300,000 amps and is one of the highest capacity units operating in this country. The unit will be used for testing thermal and mechanical effects of extremely high short circuits on switches and other apparatus. The power generated by the transformer would explosively disintegrate No. 2 solid copper on contact or melt a two inch diameter copper conductor in four seconds.

A low impedence autotransformer has been added for short circuit testing at voltages from 18 through 36 kv.

To provide continuous currents to 40,000 amps for testing thermal capacity of any current carrying apparatus, a heat run transformer has been installed.

The fourth new unit at the laboratory is a series regulating transformer which provides fine voltage regulation as low as ⅓ percent on the main power laboratory bus.

New Copperweld Offices Begun

Construction of headquarters offices for the Wire and Cable division of Copperweld Steel Co. was begun last month, according to F. E. Lieb, vice president in charge of the division. Target date for completion is the spring of 1961.

The new three-story building will be erected on the plant property in

Glassport, Pa., and will replace several old office buildings located nearby. The structure will contain approximately 15,000 sq ft of space and will feature window-wall construction, with stone facing on the ground floor.

New office building under construction for the Wire and Cable division of Copperweld Steel Corp. in Glassport, Pa. Completion is scheduled for early in 1961.

Production Briefs

Central Cable Corp. has announced that they will erect a new plant in the Montreal Industrial district of Dekalb County, Ga. for the manufacture of a complete line of aluminum and copper conductors for utility use. The company currently operates two other plants—one in Jersey Shore, Pa., and the other in Freeport, Ill.

J. A. Weaver Co., manufacturers of electrical fittings, has started construction on a new foundry that will more than double their present production capacity. In addition to the new foundry, Weaver's present plant is being remodeled to provide for additional offices, production equipment, and additional warehouse facilities.

Sales Briefs

Multi-Amp Electronic Corp. has appointed three representatives, two in the United States. **C. B. Anderson Electric Co.,** Tulsa, Okla., will serve Oklahoma, the Panhandle and southwestern Texas, western Arkansas, and southern Kansas. **Wrathall & Krusi,** San Francisco, Calif., will serve that state from Lompoc, Santa Maria and Bakersfield north to the Oregon border, plus most of Nevada. Third representative appointed is **International Engineering Co.,** Ltd., Bangkok, Thailand.

Two new **service center networks**—one for outdoor fluorescent ballasts, the other for plastic sign fluorescent units—have been established by **General Electric's Ballast department**, Danville, Ill.

The Heckerman Corp. has been named western sales representative for **Simplex Wire and Cable Co.** Their offices are in Inglewood, Calif.

A new program of selling key products through electrical supply distributors has been announced by **Dearborn Chemical Co.**, manufacturers of protective coatings for corrosion control. A nation-wide distributor chain will be set up under the direction of Glen R. Pierce, manager of the newly created distributor sales division.

Appointment of **Randolph Engineering Co.**, El Monte, Calif., as representatives for **Performance Measurement Co.** has been announced. The firm, under H. J. Randolph, has represented major power equipment manufacturers for over 10 years.

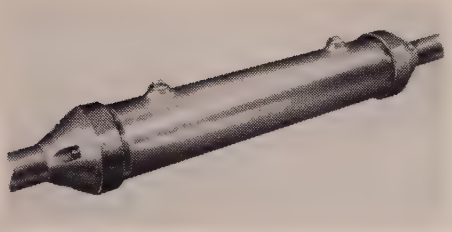
H. Zinder & Associates, consultants and engineers specializing in energy resources, has opened a San Francisco office.

Fanner Mfg. Co. has named **Smith Sales Co.** of Albuquerque, N. M. as its sales representative for the entire state of New Mexico and El Paso County, Texas.

Two representatives have been appointed by **Teleflex, Inc.,** manufacturers of mechanical controls and linkages used in the nuclear field; **R. J. deRecat & Co.,** San Francisco, Calif., will represent the company in Arizona, California, Colorado, Nevada, New Mexico, and Utah, and the **Ron Marston Co.,** Seattle, Wash., will represent it in Idaho, Oregon, and Washington.

Pfaff & Kendall and **Oliver Electrical Mfg. Co.** have announced a joint program for the expanded sale of P & K aluminum pole lighting brackets. Oliver will handle the sale and promotion of the line and will store the brackets in their district warehouses, as an addition to the Oliver group of pole line hardware products.

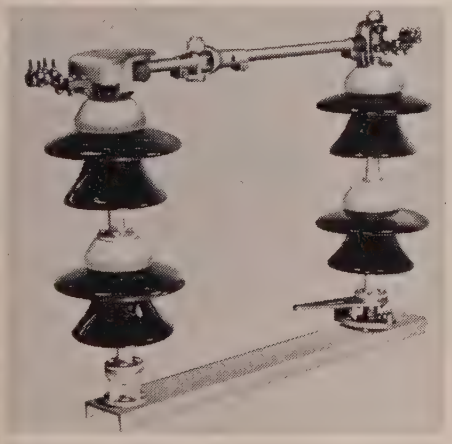
NEW PRODUCT DESIGN



Aluminum-Sheath Cable Joint

Housings of 4-, 5-, 6-, 8-, and 10-in. diameters and variable lengths for use with cable up to 5½-in. OD, are available as part of a kit for making sealed pressure-tight joints for oil-filled or gas-filled low- and medium-pressure aluminum-sheathed cable. Requires no soldering or welding during installation. Manufactured and distributed by **G&W Electric Specialty Co.**

Circle item #32 on reply card



Side Break Switch

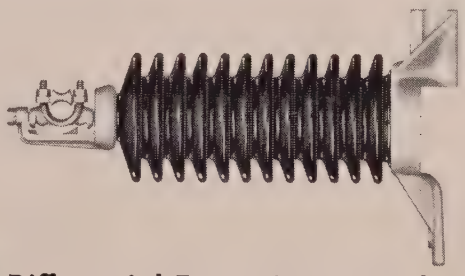
Type 57L braidless side break switch is available in voltage ratings of 7.2 kv through 161 kv and continuous ratings of 400, 600, and 1200 amperes. By **Southern States Equipment Corp.**, the switch features a unique swivel assembly that eliminates the need for braided shunts. Swivel assembly has adequate capacity for short-circuit currents and is free from corrosion and contamination. One insulator rotates for operation.

Circle item #33 on reply card

Horizontal Post

A horizontal line post with a new clamp design by **Ohio Brass Co.** makes hot line work quick and convenient. Clamp consists of a saddle supported on its base by two pintles, one fixed and one free. Installation is almost automatic. Eliminates the cost of installing crossarms and associated hardware. Unit is designed for narrow right-of-way, permits longer spans in some applications, and lowers maintenance costs.

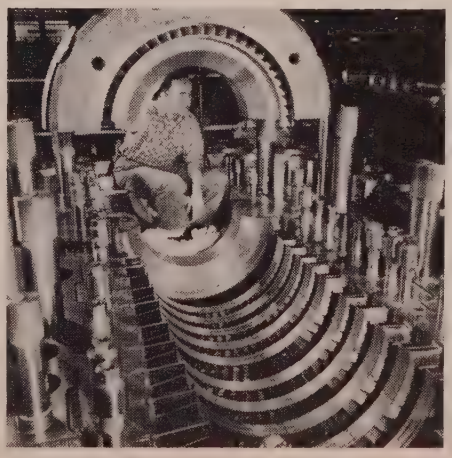
Circle item #34 on reply card



Differential Expansion Control

Separate ring-type nozzle chests and inner cylinder blade rings isolate these faster heating sections of **Allis-Chalmers** high temperature steam turbines from the slower heating, outer cylinder, preventing distortion and minimizing thermal stresses due to differential expansion. Shown in the picture is the high pressure cylinder of a 357,000-kw steam turbine-generator to be installed by Consolidated Edison as unit No. 4 in their Astoria Station.

Circle item #35 on reply card




TOYS

Impedance of the new Westinghouse 500-kva transformer is 2%, a 62% reduction below conventional substation units. Total electrical losses—slashed 26%. These savings are predictable, calculable, add up to $449.57 per year and every year for the 30-year life of the equipment. Based on industry-accepted methods of evaluation, this amounts to $13,487.10.

new 500-kva transformer saves $449.57 per year for life of the transformer

Weight has been reduced 22% to 3100 pounds . . . as much as 1000 pounds less than conventional substation transformers. Height, at 64", is 22% lower. Handling and mounting on pole or platform are decidedly easier, faster, less expensive.

The new Westinghouse 500-kva transformer can help you meet rising loads from new shopping centers and developing industrial areas, economically.

Ask your Westinghouse salesman about it.

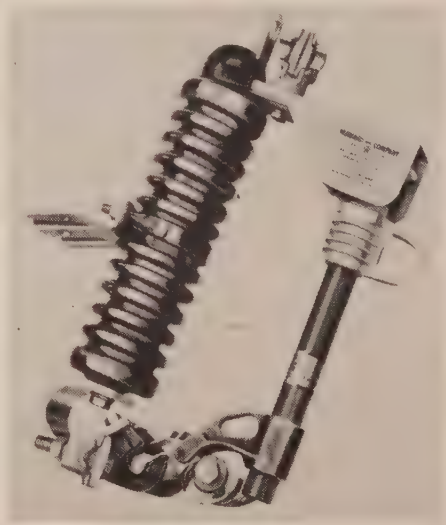
You can be sure . . . if it's Westinghouse.

Westinghouse

200-amp Cutout

A 200-amp, open drop-out cutout featuring single vent, small bore design is available from **Hubbard and Co.** Possesses interrupting capacities of 12,000 amps at 7.8 kv and 10,000 amps at 15 kv through use of thrust-absorbing recoil mechanism and fiberglass fuse tube. Roll action fuse ejector offers a positive means of ejecting one-, two-, and three-leader fuse links, preventing possibility of restriking an arc during fault interruption.

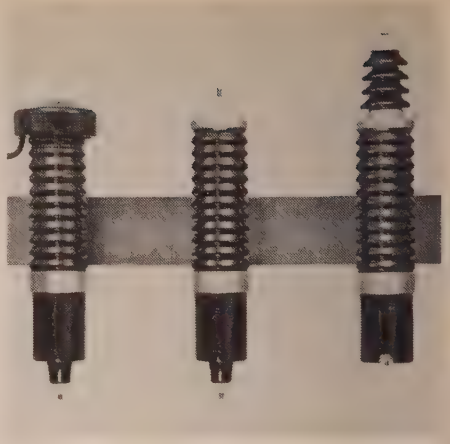
Circle item #36 on reply card



Compression Tool

A hydraulic compression tool available from **James R. Kearney Corp.** makes possible compression connections *hot* on all wire sizes from #6 solid through 636 MCM ACSR. A two step high speed pump exerts 21,000 lbs thrust while an automatic overload valve prevents over-compression. A partial turn of one hand will set the tool to compress or instantly retract dies. Interchangeable insulated handles are available from 1 to 6 ft.

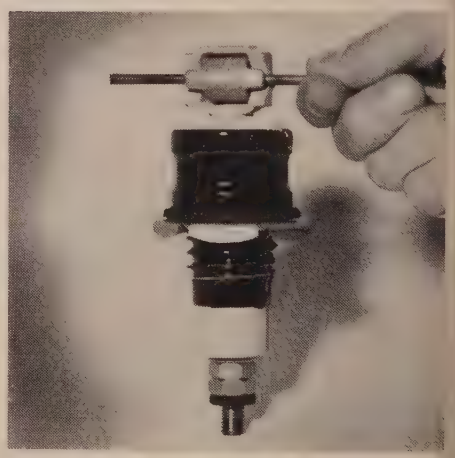
Circle item #37 on reply card



Valve Arrester

A complete line of 3- to 18-kv distribution valve arresters utilize a series of short quench and isolating gaps in unit structures with electrostatic shielding to obtain low impulse sparkover. Micro-Pack valve element of silicon carbide insures high thermal capacity and low discharge voltage characteristics. Available with either stud connectors or insulated line leads. By **Joslyn Mfg. and Supply Co.**

Circle item #38 on reply card

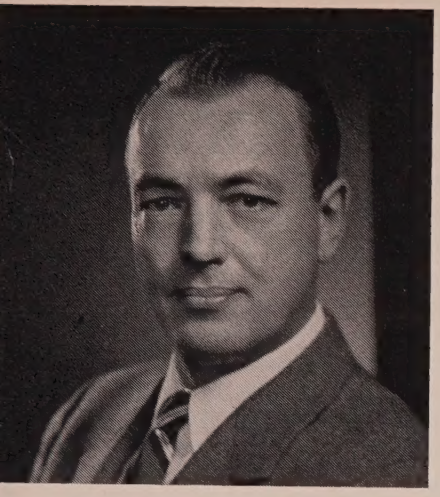


Threaded Bushing

A low voltage transformer bushing designed for internal mounting with a single screw-on type retaining nut is available from **Lapp Insulator Co.** The bushing is recommended for transformer applications to 1.2 kv. Lower end of the porcelain is threaded for easy mounting on the transformer case. Simply tightening the spring steel nut on the threaded shank of the bushing makes a leak-proof installation.

Circle item #39 on reply card

Gross Combustion V. P.



Lambert J. Gross has been elected vice president and treasurer of Combustion Engineering, Inc. Mr. Gross succeeds Otto W. Strauss who continues as a vice president of the company until his retirement in October.

Mr. Gross was formerly vice president—finance and treasurer and a member of the board of management of General Dynamics Corporation. He joined General Dynamics as comptroller in 1947 and was named a vice president in 1951.

Make Two Executive Reassignments at CEI

Two vice presidents of The Cleveland Electric Illuminating Company have been named to new posts. Albert A. Casey was elected Vice President – Engineering, and Harry T. Sealy was named Vice President – Operations. Both appointments became effective last month.

Mr. Casey succeeds Clarence J. Beller, who will retire in September after 35 years of service. He will be in charge of all the Company's engineering elements.

Mr. Sealy's new Operations Group will combine the Distribution Group which he now heads with the System Operations Group presently headed by Mr. Casey.

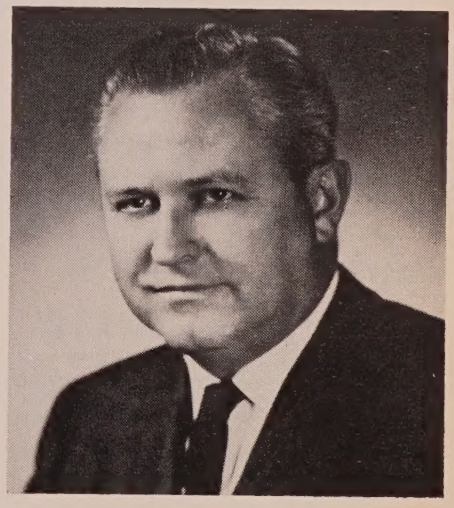
Merger of the two elements is in line with the Company's long-term plan to integrate and coordinate all its operating functions.

Until his retirement, Mr. Beller will remain a vice president in the Engineering Group.

Mr. Casey and Mr. Sealy have been vice presidents since 1953.

MEN OF POWER

Blanchar To Head Indiana P. S.



R. A. Gallagher, Chairman, Public Service Company of Indiana, Inc. has announced that the board of directors has elected Edmond W. Hebel to the position of Vice Chairman; and Carroll H. Blanchar to the position of President succeeding Mr. Hebel.

Mr. Blanchar was also elected a member of the board of directors succeeding retired director Ralph K. Clifford, formerly of Kokomo and now a resident of Fort Lauderdale, Florida.

Mr. Blanchar resigned as president and director of the Roddis Plywood Corporation, Marshfield, Wisconsin, to become president of Indiana's largest electric utility. He is a certified public accountant.

The new utility executive began his business career in 1933 with the accounting firm of Arthur Anderson & Company in Chicago. He later held executive positions with Commonwealth Edison Company, United Airlines Corporation and the Roddis Plywood Corporation prior to joining Public Service Company.

Daystrom Names Degen and Klein

Joseph F. Degen has been named vice president and general manager of Daystrom, Incorporated, Weston Instruments division of Daystrom, Inc., (Newark and Poughkeepsie) according to an announcement by Thomas Allinson, president of the company's Industrial Products Group.

Edward L. Klein succeeds Mr. Degen as vice president, operations, of Weston Instruments Division, Newark. Prior to his present appointment, Mr. Degen was vice president of operations at Weston's Newark plant. He joined the Company in 1957 as vice president of manufacturing. Earlier, 1946 to 1957, he was general superintendent of the Poughkeepsie, N. Y. plant of the International Business Machines Corporation.

In his new position, Mr. Klein will be responsible for engineering, manufacturing, industrial relations and quality control at Newark, the Faraday plant, Union, and the Ponce, Puerto Rico, plant.

Prior to his present position, Mr. Klein served as director of manufacturing from April 1959 and before that as general superintendent. He joined the company in 1952 as assistant foreman of engineering inspection.

Marx NSP V. P.

W. N. Marx, manager of Northern States Power Company's Sioux Falls division, has been named vice president in charge of operations for Northern States Power Company of Wisconsin. He succeeds the late E. H. Cotton.

Mr. Marx, who has worked for NSP for 31 years, began his employment with the company as a draftsman in the engineering department in Eau Claire, he was em-

ployed there from 1929 to 1947.

In 1952 he was named general superintendent of the company's Sioux Falls division. In December, 1953, he was appointed manager of NSP's Southwestern division with headquarters in Montevideo, and in January, 1956, he was made manager of the Sioux Falls division.

MEN OF POWER BRIEFS

UTILITY

John T. Shewmake, President of Southwestern Electric Service Co., has been honored as "Man of the Month" by East Texas Magazine, official publication of the East Texas Chamber of Commerce.

Recently appointed electrical distribution manager, Saskatchewan Power Corp., is **Karl W. Allcock.**

Two recent promotions in the engineering division of Dayton Power and Light are: **William J. McLain,** chief electrical engineer, and **Richard H. Neal,** supervisor of the transmission and distribution section.

West Penn Power has announced four Executive changes: **Alton T. Emmons,** has been elected to the post of Controller, and **Russell E. Caywood,** has been named assistant vice president, **John F. McQuillin,** has been appointed assistant to the vice president of marketing, and **Donald T. Faust,** has become eastern division manager.

Thomas E. Marburger, vice president, engineering and construction, Baltimore Gas & Electric, has been elected a member of the board of Directors of the Atomic Power development Associates, Inc.

Richard L. Rosenthal, president of Citizen Utilities has announced three Executive promotions. They are: **John C. Gibbs,** from vice president, operations and engineering, to senior vice president; **Joseph E. Griffin,** from treasurer to vice president and treasurer; and **Ishier Jacobson,** former assistant vice president, promoted to vice president.

Recently elected vice president of the Controllers Institute of America was **Burdette A. Johnson,** Treasurer, New England Gas and Electric Association.

R. R. Murdoch has been appointed assistant to the chairman of the board and president, Duquesne Light Company.

PEAK-LOAD ENERGY . . .

(Continued from page 54)

pressure and net station heat rate for different fuels. In each case the fuel fired for the normal capacity is also fired for the peak capacity.

Studies have also been made on the basis of oil firing in a coal-fired boiler, for all heat input over and above that required to develop the normal 250-mw. Experience with simultaneous coal and oil firing has not been conclusive to date but there is some evidence this may result in an aggravated slagging condition. Therefore, it may be necessary to conduct some experimental work with the particular fuels to be burned before proceeding with such an arrangement.

Schemes C, D, E and F indicate an exhaust loading in excess of that recommended by some turbine designers and as previously mentioned it may be necessary to reduce the peak load or change the exhaust end of the unit before proceeding with such an arrangement.

Table II summarizes the estimated investment requirements for each of the different schemes considered. The 250-mw unit with or without peaking capability is assumed to be a new plant on a new site. Prices for the turbine-generator and steam generator are the averages of those obtained from the manufacturers while the costs were estimated for the other equipment and material affected.

From this tabulation it may be noted that, at present price levels, peaking capacity may possibly be obtained at an incremental cost of about $30 to $39 per kw for gas firing depending on the scheme selected.

This compares to the estimated cost of $102 per kw for the base plant. For comparative purposes, a 100-mw gas-fired unit installed specifically for peaking purposes is estimated to cost $90 per kw. This cost would increase to about $93 per kw for an oil-fired plant.

The cost of a high-efficiency reheat, gas-fired plant of 325- to 350-mw capacity instead of the 250-mw unit considered was also estimated and the incremental cost over the base 250-mw plant is approximately $75 per kw.

In a coal-fired system where coal is also used for peaking it is necessary to add pulverizer equipment and extend the coal-handling equipment as substantial peaking capability is added to the base 250-mw unit. The cost for this plant is estimated to be $36 to $41 per kw. The cost of the base coal-fired plant is estimated to be $122 per kw.

In a coal-fired system where oil is used for peaking, the incremental cost for obtaining peaking capacity is estimated to be $33 to $48 per kw except for Scheme G. In this scheme no additional pulverizing capacity is required to obtain the peak capability with coal firing due to the margins built into the base plant. However, when the peak is obtained with oil-firing then additional equipment must be added. The incremental cost of Scheme G with oil-firing is estimated to be $41 per kw as compared to $39.50 for coal-firing at the peak.

Since these costs are based on estimated prices for steam generator and turbine generator and recognizing that each situation will be accompanied by its own special circumstances, it is considered that the incremental cost of peaking capacity may be somewhat higher than indicated.

Conclusion

Many utility systems may today be in a position of requiring relatively low-cost incremental capacity for use at the time of system peaks and equipment is today available to meet these requirements. Only a few possible methods of achieving the desired result have been described; however, the intense interest on the part of utilities and manufacturers will no doubt result in the development of other and possibly more attractive ideas. It is evident that means must be found, and used, to reduce the ever-increasing capital expenditures necessary to meet the peak

demands that contribute but little to energy sales.

The installation of peaking capability in a high-efficiency reheat unit may offer the advantages of low initial cost for peaking capability, ability to pick up load almost instantaneously, and elimination of the need for additional operating manpower to obtain the peaking capacity. Thus such a unit may readily fit into the plant of an operating utility.

—Equipment For Sale—

NEW UNUSED 900 KW GE GENERATOR OFFERED FOR PROMPT SALE

Owner selling one (1) new, unused 900 KW, 1125 KVA General Electric Generator, now in protected storage at South San Francisco plant. Specifications: Serial No. 6955112, .8 power factor, 360 RPM, 50° centrigrade rise, 2400/4160 volt, 3 phase, 60 cycle, 6 wire, open engine type, with damper windings, field discharge resistor, stator sole plates, stator shift and brush rigging with supports, floor mounted exciter, exciter slide rails and field rheostat. Immediate sale desired. To inspect and submit offer, *contact Sales Department, Enterprise Engine & Machinery Co., P. O. Box 949, San Francisco, Calif.*

—Help Wanted—Engineers—

ELECTRIC UTILITY PERSONNEL

CHIEF POWER SYSTEM ENGINEER

POWER PLANT SUPERINTENDENT

POWER PLANT SHIFT SUPERVISORS

For a utility within 100 miles of Philadelphia consisting of a new high pressure 33,000 KW steam power plant, an existing 8,500 KW steam power plant, and a distribution system covering 88 square miles. Minimum 5 years' experience. Good working conditions. All applications will be acknowledged.

THE KULJIAN CORPORATION
1200 NORTH BROAD STREET
Philadelphia 21, Pa.

CALENDAR OF EVENTS

August 9-12—American Institute of Electrical Engineers, Pacific General Meeting, El Cortez Hotel, San Diego, Calif.

September 7-9—Northwest Electric Light and Power Association, Annual Convention, Glacier Park Lodge, Glacier National Park, Mont.

September 7-9 — American Society of Mechanical Engineers, Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass.

September 15-16—American Society of Mechanical Engineers, Engineering Management Conference, Morrison Hotel, Chicago, Ill.

September 21-23—Inter-Industry Farm Electric Utilization Council, National Electric Farm Power Conference, Hotel Louisville, Louisville, Ky.

September 26-30 — Instrument Society of America, Fall Instrument - Automation Conference and 15th Annual Meeting, New York Coliseum, New York, N. Y.

September 28-30—Indiana Electric Association, 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

September 29-30—Electric Companies Public Information Program, 1960 PIP Workshop Conference, Sheraton-Charles Hotel, New Orleans, La.

September 29-30—Southeastern Electric Exchange, Accounting Conference, Tides Hotel, St. Petersburg, Fla.

October 5-7—Wisconsin Utilities Association, Electric and Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wisc.

October 6-7—Electric Council of New England, Transmission and Distribution Committee Meeting, Lake Morey Inn, Fairlee, Vt.

October 9-14—American Institute of Electrical Engineers, Fall General Meeting, Morrison Hotel, Chicago, Ill.

October 20-22—Electric Companies Public Information Program, Second National Youth Conference on the Atom, Museum of Science and Industry, Chicago, Ill.

November 9-11—American Institute of Electrical Engineers, Second Power Industry Computer Application Conference, Chase Hotel, St. Louis, Mo.

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